INSTRUCTION MANUAL

MODEL L-7250 PROGRAMMABLE AUTOSAMPLER

ADVANCED OPERATION

Read and keep this manual

- Read safety instructions carefully and understand them before starting your operation.
- Keep this manual at hand for reference.

HITACHI

INSTRUCTION MANUAL

FOR

MODEL L-7250 PROGRAMMABLE AUTOSAMPLER

ADVANCED OPERATION

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6th Edition, November 2000
1st Edition, 1994
Part No. 810-9253-5 TT-TF (FTT-LT)

This instruction manual describes the advanced operational procedures of the Model L-7250 Programmable Autosampler. Complete the autosampler installation and master each basic operation before attempting to perform any of the tasks given in this manual. This ADVANCED OPERATION manual is designed for a person who has mastered the BASIC OPERATION manual and is able to use the L-7250 Autosampler with ease.

How to Use this Manual:

This ADVANCED OPERATION manual includes the following chapters:

1. Operation of the Programming Functions

   This chapter describes how to use some of the autosampler advanced functions to perform sample preparation before injecting samples into a liquid chromatograph. In addition, it shows how you can program the autosampler to automatically dilute, mix and dispense measured amounts of samples or reagents.

2. External Communication Functions

   This chapter describes the connection and operation procedures between a peripheral device and the autosampler. There are two connection methods. One is through the D-line communication and the other is through contact point signals. Both ways allow you to control the autosampler via its external communication function.

3. Communication Functions via RS-232C

   This chapter explains how an external system, such as a personal computer, can control the autosampler functions via RS-232C communication. RS-232C communication is a standard L-7250 autosampler feature.

4. Optional Accessories

This chapter describes use of the optional accessories of the L-7250 Autosampler. Optional accessories enhance the power of your autosampler. For example, there is a description of the use of optional syringes, special racks, and the pump piston washing capability.

Consult each of these four chapters to learn about the details of each function or accessory.

⚠ SAFETY SUMMARY

⚠ General Safety Guidelines

Before using the L-7250 programmable autosampler, carefully read the safety instructions given below.

- Operate the instrument according to the instructions in this manual.
- Be sure to observe the warnings indicated on the product and in the instruction manual. Failure to do so could result in personal injury or damage to the product.
- The hazard warnings which appear on the warning labels on the product or in the manual have one of the following alert headings consisting of an alert symbol and a signal word DANGER, WARNING or CAUTION.

⚠	**DANGER** :	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. (This warning does not apply to this product.)
⚠	**WARNING** :	Indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.
⚠	**CAUTION** :	Indicates a hazardous situation which, if not avoided, will or can result in minor or moderate injury, or serious damage to the product.
⚠	:	The alert symbol shown at left precedes every signal word for hazard warnings, and appears in safety-related descriptions in the manual.
Important	:	Used for instructions other than the above in order to prevent damage to the instrument.
Note	:	Used information and descriptions that are provided to ensure correct usage.

⚠ SAFETY SUMMARY

⚠ General Safety Guidelines (Continued)

- Keep in mind that the hazard warnings in this manual or on the product cannot cover every possible case, as it is impossible to predict and evaluate all circumstances beforehand.
  Be alert and use your common sense.

- When using a chemical for analytical operation, be sure to provide proper ventilation of the laboratory room per local requirements. Inadequate ventilation could endanger human health.

- Do not modify the instrument, replace parts that are not user-serviceable, use non-specified parts, nor remove safety devices, as it could be hazardous.

- Installation at delivery, maintenance and relocation should be referred to service personnel qualified by Hitachi.

- Do not perform any operation or action other than described in this manual. When in doubt, please contact your local Hitachi sales representative or nearest Hitachi service office.

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1 OPERATION OF THE PROGRAMMING FUNCTION

This chapter describes the autosampler programming function. The model L-7250 Programmable Autosampler has a programming function which is useful for sample preparation. You can build programs by combining some unique and powerful autosampler commands. These commands provide you with maximum flexibility to dispense, dilute, add, and mix liquids.

1.1 Summary of the Programming Function

The model L-7250 Programmable Autosampler has two operating modes. One mode is the sequential mode that is used to analyze the samples you place in the autosampler rack in a set order. The other mode is the programming mode that is capable of performing random vial access and sample preparation. You can switch from one mode to the other through the **MODE** key.

The programming mode provides the following functions:

(1) You can create a program that controls movement of the autosampler sampling mechanism.
(2) You can create programs that combine the commands listed in Table 1-1.
(3) You can create the program and monitor its action by actually moving the mechanism while operating in the TEACH mode.
(4) You can edit any program step via the edit function.
(5) You can save up to 30 programs in a battery backed-up memory.

Table 1-1 Program Command List

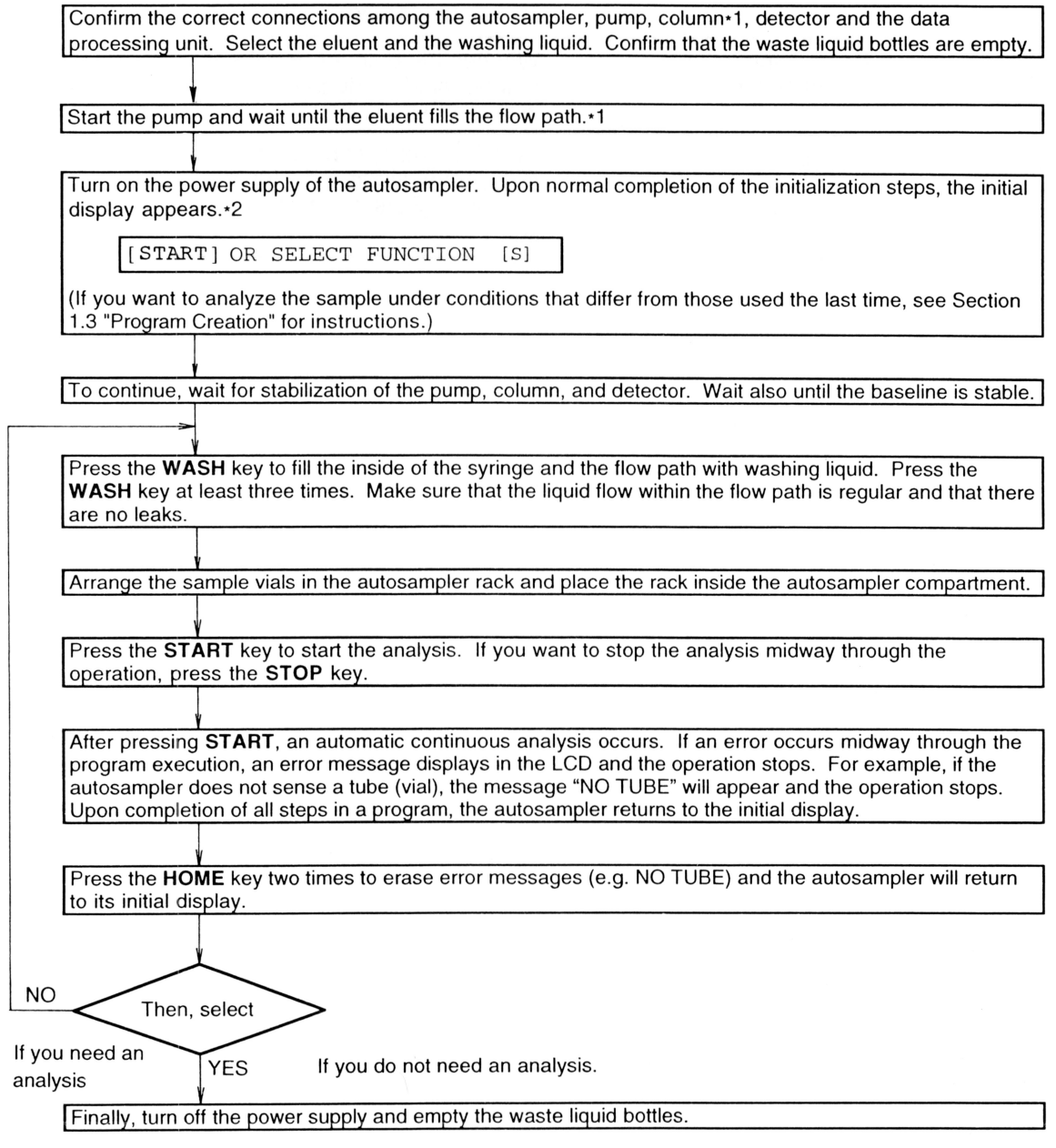
No.	Command	Parameter	Function
1	TUBE	Rack code, tube number	Moves the needle to a designated tube (vial)
		0, port number	(Moves to the washing port at TUBE 0 0, or to the injection port at TUBE 0 1.)
2	ASP (aspirate)	Aspiration volume, aspiration rate	Lowers the syringe plunger and aspirates (takes up).
3	DISP (dispense)	Dispensing volume, dispensing rate	Raises the syringe plunger and dispenses the liquid.
4	HEIGHT	Height, moving speed	Moves the needle to a designated height.
5	VALVE	Position	Switches the injection valve to a designated position.
6	WAIT	Wait time	Waits for a designated time (Unit time: seconds)
7	WAITTIMER	-	Waits until the end time specified by the TIMER command. (Sets the time with the WAIT key.)
8	WAITSIGNAL	Bit number, level	Waits until the specified bit of an input port reaches a specified level. (Sets it with the WAIT key.)
9	TIMER	Time	Sets the timer.(Unit time: seconds)
10	OUT	Bit number, level	Sets the designated bit of an output port to a designated level.
11	MOVE	Positions the sampling needle on the X, Y and Z scales.	Moves the needle to a designated position. (Sets it with the FUNC1 KEY.)
12	SYRINGE	Position	Moves the syringe plunger to a designated position.
13	SVALVE	Position	Switches the syringe valve to a designated position.
14	SNGLINJ	Rack code, tube number, injection volume	Injects the specified sample only once. (Sets it with the FUNC2 KEY.)
15	SEQINJ	-	Sequential injection. (Sets it with the FUNC2 key.)
16	DO	No. of repetitions, variable number, initial value, variable increment	Designates a repetition.
17	LOOP	-	Designates an end of a repetition.

(cont'd)

No.	Command	Parameter	Function
18	HOME	-	Returns the sampling mechanism to the home position.
19	WASH	-	Moves the needle to the washing port or injection port and dispenses the washing liquid.
20	PWASH	Dispensing volume, dispensing rate	Washes the plunger and the plunger seal of the pump. (Sets it with the FUNC1 key.)
21	OPVALVE	Position	Switches the optional high pressure valve to a designated position. (Sets it with the FUNC1 key.)

1.2 Routine Analyzing Operation

The program remains in the autosampler battery backup memory when you turn the power off. The program is not erased. After writing a program and you are ready to run an analysis, do the following tasks:



*1 Before connecting a new column, fill the flow path with the eluent to prevent air from entering the column.
*2 If the initial screen does not appear, press the **MODE** key.

1.3 Program Creation

1.3.1 Function of the Operation Keys

Figure 1-1 shows the operational keypad of the Model L-7250 Programmable Autosampler.

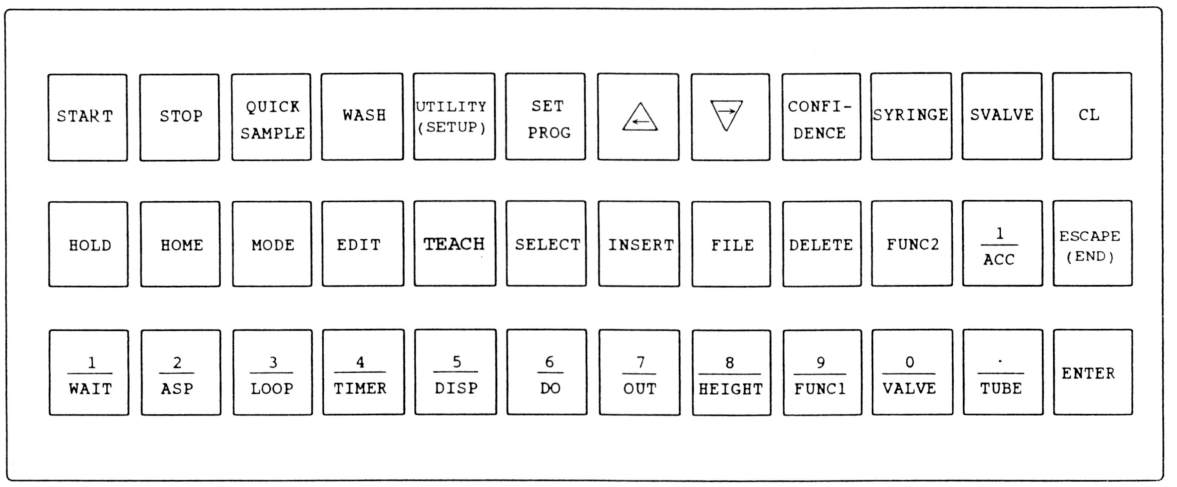


Figure 1-1 Keypad

The following section explains the function of each of the keys and how to use them in the programming mode.

1. Execution Keys

START	Starts execution of a selected program.
STOP	Stops execution of a program.

2. Keys for Parameter Input

1 9 , .	Value keys.
I	You can enter a variable (I1-I20) in either the TEACH or the EDIT mode.
CL	Deletes data during its input(prior to pressing **ENTER**).
ENTER	Enters a value or variable.

3. Keys for Program Creation

TEACH	Initiates the teaching mode. Teach allows you to create a program while checking the command execution.
EDIT	Initiates program editing.
FILE	Saves or loads a program.
DELETE	Deletes one line of a program in either the EDIT or the TEACH mode.
INSERT	Adds one program line during the EDIT mode.
△	Moves the display of a program list, etc. upward or moves the cursor to the left.
▽	Moves the display of a program list, etc. downward or moves the cursor to the right.
SELECT	Selects the direction to move the needle when setting a rack parameter, the HEIGHT or the MOVE command parameter.
ESCAPE (END)	Terminates creation or editing of a program. Suspends processing and resumes the initial display while in the programming mode.

4. Command Keys

TUBE	Moves the needle to a designated tube (vial) or, when creating a program in the EDIT or the TEACH mode, sets the TUBE command.
ASP	Aspirates via the needle as much liquid as specified or, when creating a program, sets the ASP command.
DISP	Dispenses a designated volume of liquid from the needle or, when creating a program, sets the DISP command.
HOME	Returns the needle, valve and entire mechanism to its origin or, when creating a program, sets the HOME command.
WASH	Washes the needle, syringe and injection port or, when creating a program, sets the WASH command.
HEIGHT	Moves the needle to a designated height or, when creating a program, sets the HEIGHT command.
VALVE	Switches an injection valve or, when creating a program, sets the VALVE command.

(cont'd)

TIMER	Use the TIMER command to set the timer when creating a program. Use timer along with the WAITTIMER command.
WAIT	When creating a program, use the following commands to create a wait step. (1) WAIT : Waits for as many seconds as you choose. (2) WAITTIMER : Waits for the time you specify in the TIMER command. (3) WAITSIGNAL: Waits for a signal input.
OUT	When creating a program, use the OUT command to specify the bit of an output port and the level.
SYRINGE	Moves the syringe plunger to a specified position or, when creating a program, sets the SYRINGE command.
SVALVE	Selects the syringe valve position or, when creating a program, sets the SVALVE command.
FUNC1	(1) MOVE : Moves the needle to a designated position or, when creating a program, sets the MOVE command. (2) PWASH : Washes the plunger and the plunger seal of the pump. (3) OPVALVE : Switches the optional high pressure valve to a designated position.
FUNC2	(1) SNGLINJ : Injects the specified sample once. Injection conditions are those set for the sequential mode. (2) SEQINJ : This command does not display except when you are creating a program. Sets the SEQINJ command for sequential injection.
DO	When creating a program, sets the DO command for repeated processing. Use the DO command with the LOOP command.
LOOP	When creating a program, sets the LOOP command for repeated processing. Use the LOOP command with the DO command to bracket the steps you want to repeat.
ACC	Executes or sets a command for controlling an accessory.

5. Other Keys

UTILITY (SETUP)	Sets the analysis conditions. (For instructions, see the L-7250 Autosampler BASIC OPERATION Manual.)
MODE	Selects either the programming mode or the sequential mode.

1.3.2 Flow of Operation in the Programming Mode

Figure 1-2 shows the operational flow while the autosampler is in the programming mode.

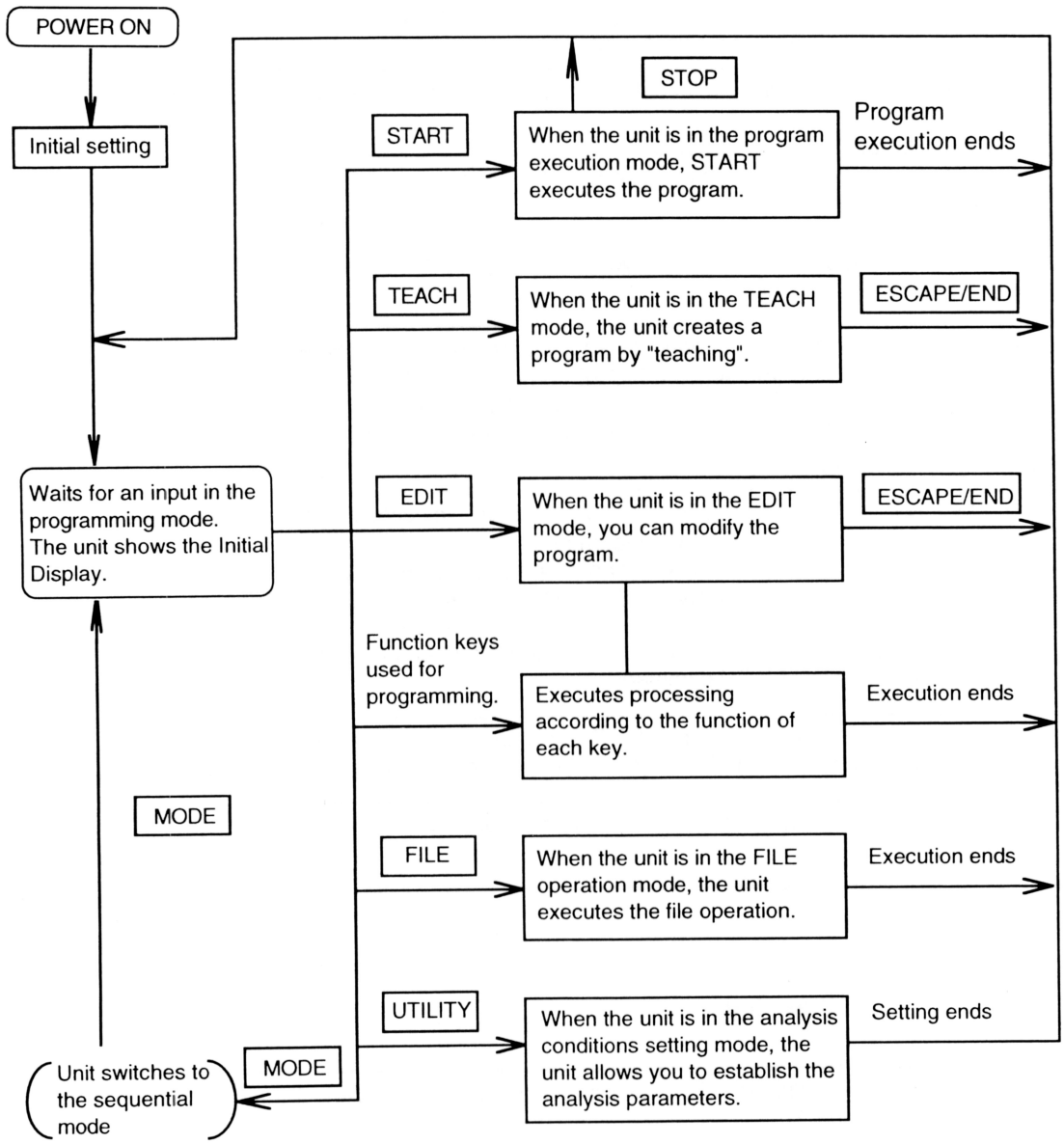


Figure 1-2 Operation in the Programming Mode

1.4 Program Creation

1.4.1 Program Creation by Teaching: TEACH

The **TEACH** function enables you to create a program while checking the execution of each command.

1. Operating Procedure

1a. Press **TEACH** while the unit is at the initial display and in the programming mode.
A message appears asking whether you want to delete the program or not.
Selecting YES **(1 ENTER)** deletes the program present in the editor buffer and accesses the initial display of the teaching mode.
If you do not want to delete the program which is currently in the editor buffer, save the program into a file before selecting "YES".
Selecting NO **(0 ENTER)** accesses the initial display.

Interpretation:
The editor buffer stores the execution program. When operating in the TEACH mode, the commands you enter are added in sequence to the editor buffer. You need to delete the contents of the editor buffer before starting the TEACH operation. If you do not delete the contents of the edit or buffer, any new commands you enter now are added in sequence to those currently present.

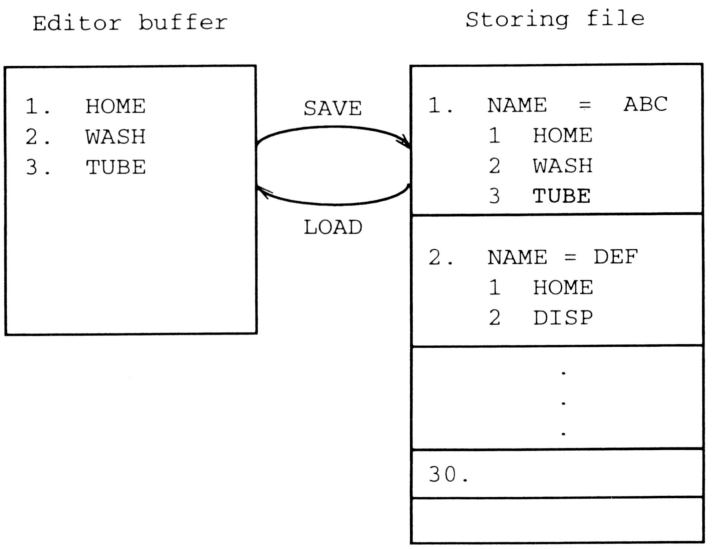
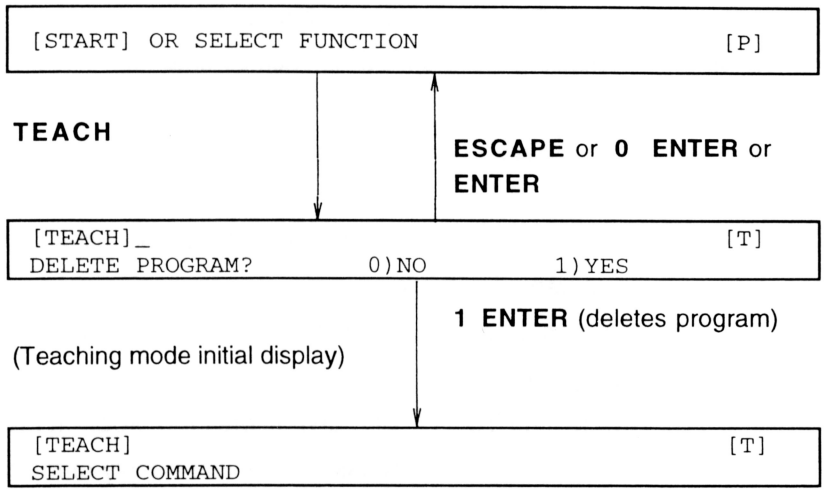
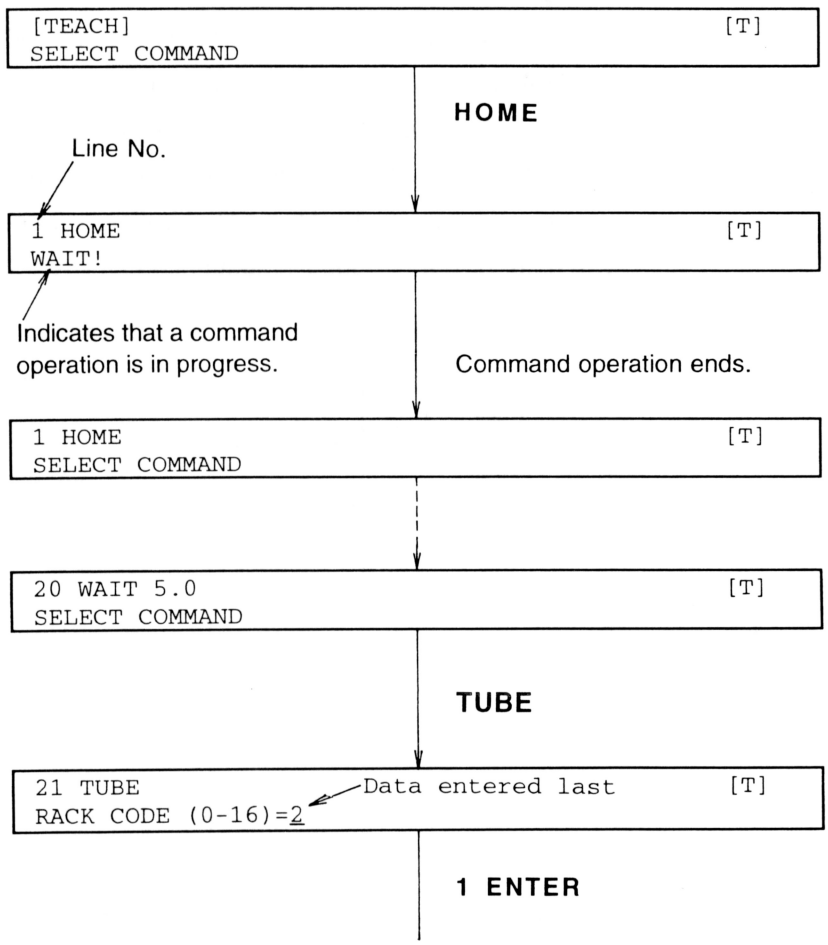


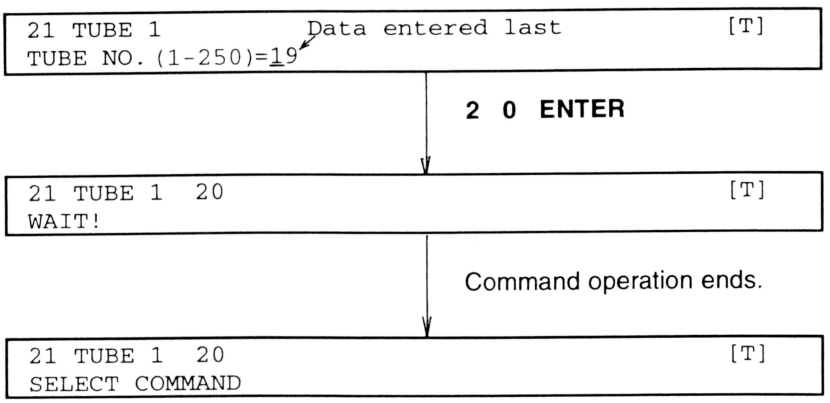
Figure 1-3 Programming Mode File

Programming Mode Initial Display:



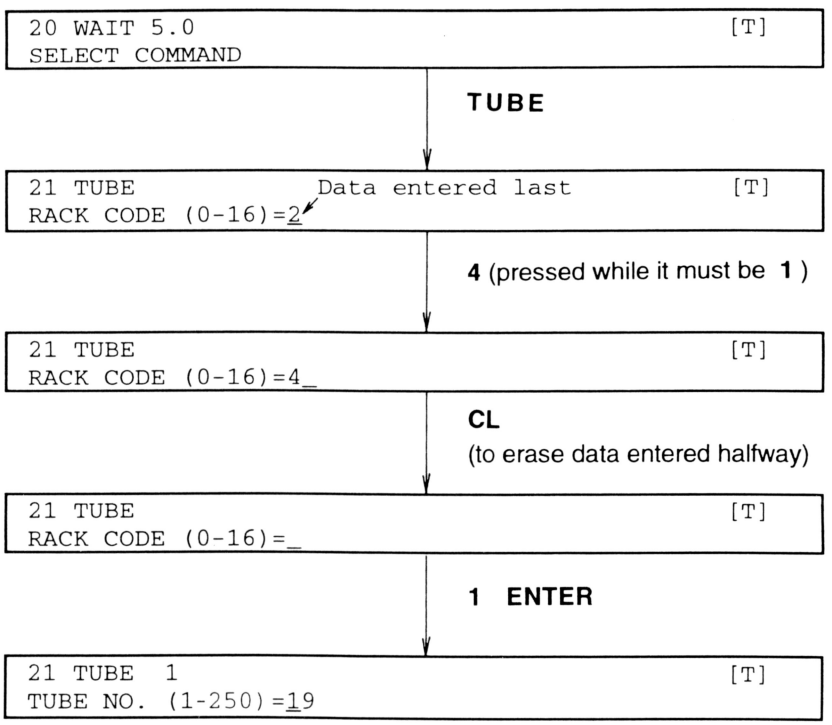
1b. Creates a processing sequence by using the programming command keys. For details on each command, see Section 1.8 and Table 1-1.





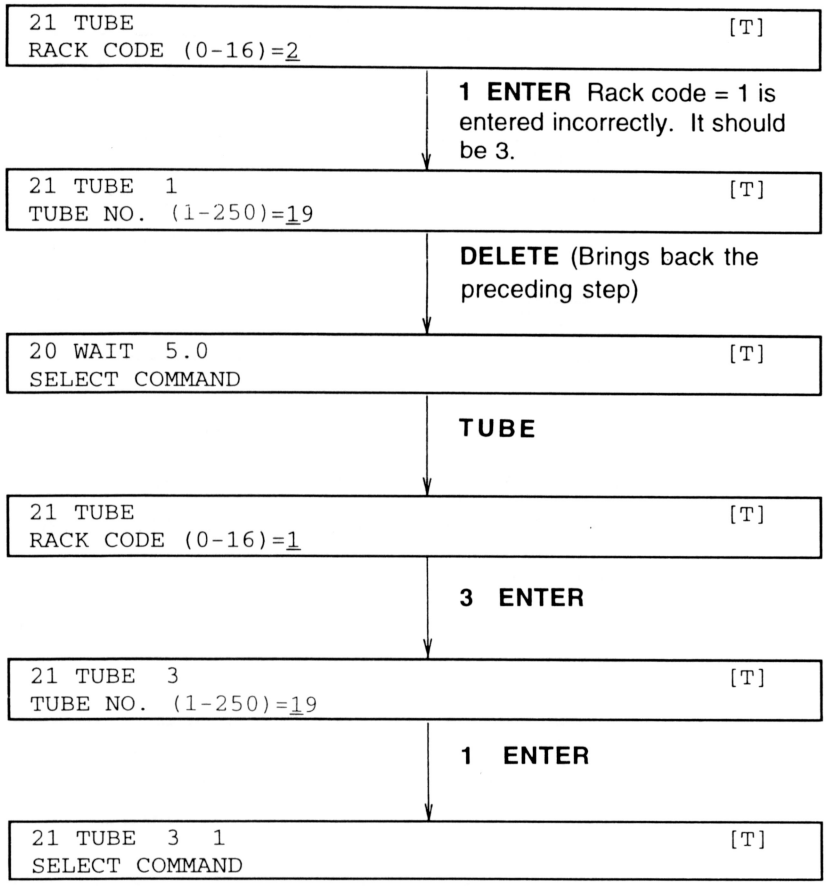
1c. When you want to alter a parameter value or a variable midway through its input, that is before pressing **ENTER**, press the **CL** key to erase the parameter and then enter the correct parameter.

Example:



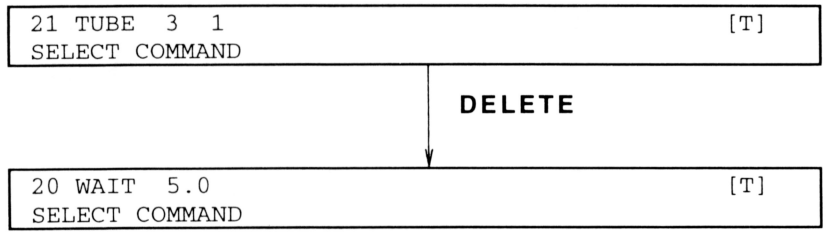
If you need to make a parameter correction immediately after pressing **ENTER**, press **DELETE**. This deletes the incorrectly entered command, and the preceding step or status line appears. Now you can make the correct entry.

Example:



1d. If you enter a wrong command, press **DELETE**.
This deletes the last command you entered and the preceding step appears.

Example: If you delete the 21st step in the above program, the autosampler will display the 20th step.



You can step back in succession up to 20 steps by pressing **DELETE**.

1e. After you create a program, press **ESCAPE** to change from the TEACH mode to the programming mode initial display. The editor buffer will register all commands you entered before pressing **ESCAPE**. If you stop the parameter input for the last command midway (that is prior to pressing **ENTER**), the editor buffer will not register that last command.

1f. To execute a program you created, press **START**. If the results you obtain are not satisfactory, press **EDIT**, modify the program and reexecute the program.
(For program editing, see Section 1.4.2.)

1g. When you obtain satisfactory results, press **FILE**. Use the SAVE function to store the program that is in the editor buffer into a file.

2. Robotic Commands HEIGHT and MOVE

You can designate the HEIGHT and MOVE parameters and their values while in the TEACH mode or set them while moving the needle with the arrow keys  or  . A similar procedure is available when using these commands during programming at the initial display.

HEIGHT command:

2a. Press HEIGHT. The controller waits for you to enter the "needle height".

```
10 HEIGHT                    As entered last          [T]
HEIGHT (0-57.0mm)=0.0
```

2b. Pressing an arrow key, △ or ▽ , opens the following display.

```
10 HEIGHT              Current needle height          [T]
HEIGHT (0-57.0mm)=10.0                              [ARROW]
```

Denotes robotic mode

Now move the needle by using the △ , ▽ keys.

△ : Raises the needle. You can monitor the needle position on the display. You can not exceed the origin (HEIGHT = 0.0).

▽ : Lowers the needle. You can monitor the needle position on the display. You can not exceed the low limit (HEIGHT = 57.0mm).

2c. When the needle reaches its intended position, press **ENTER**. The value that displays in the monitor is set as the needle height and the controller waits for you to enter a needle moving speed. After you enter the moving speed, the controller waits for you to enter a command.

Example:

```
10 HEIGHT                                           [T]
HEIGHT (0-57.0mm)=56.0                            [ARROW]
```

ENTER key

```
10 HEIGHT 56.0                                      [T]
SPEED (1-2)=2
```

ENTER key

```
10 HEIGHT 56.0  2                                   [T]
SELECT COMMAND
```

Note: If, while you are defining the needle height, you press either the numeric keys (0-9, .) or **I** - the variable designation key, instead of pressing an arrow key, you will define the parameter in terms of its value and not the needle location.

MOVE command:

2a. Press FUNC to select the MOVE command (**1 ENTER**). The controller waits for you to input the needle position for the X scale.

```
11 MOVE                          As entered last          [T]
X (0-156.0mm)=10.0
```

2b. Pressing either one of the arrow keys ◁ or ▽ opens the following display. At this moment, the needle will be set at its highest point (Z=0.0).

```
11 MOVE                                                   [T]
* X=30.0   Y=40.0   Z=0.0 (mm)                        [ARROW]
```

Current needle positions — Denotes robotic mode

Now move the needle by using **SELECT**, and the ◁ , ▽ keys. The cursor position is shown by the symbol "*".

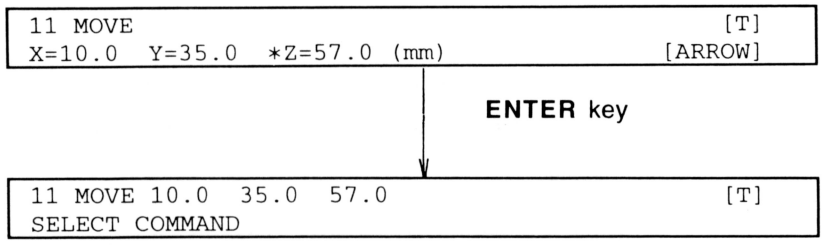
SELECT : Moves the cursor "*" to let you choose the scale to move the needle. The cursor moves in the order of X → Y → Z and back to → X.

◁ : The left arrow moves the needle toward, but not past the origin (home position).
At the same time, you can monitor the needle position on the display.

▽ : The right arrow moves the needle away from the origin, but not past the high limit.
0 ≤ position on X scale ≤ 156.0 mm
0 ≤ position on Y scale ≤ 156.0 mm
0 ≤ position on Z scale ≤ 57.0 mm

2c. Press **ENTER**, after placing the needle at a desired position. The values you monitor in the display are set as parameters for positions on the X, Y and Z scales. After defining the parameters, the controller waits for you to enter the next command.

Example:



Note: If while you are defining the needle position, you enter the numeric keys (0-9, .) or the **I** variable designation key instead of pressing an arrow key, the parameter is defined in terms of this value.

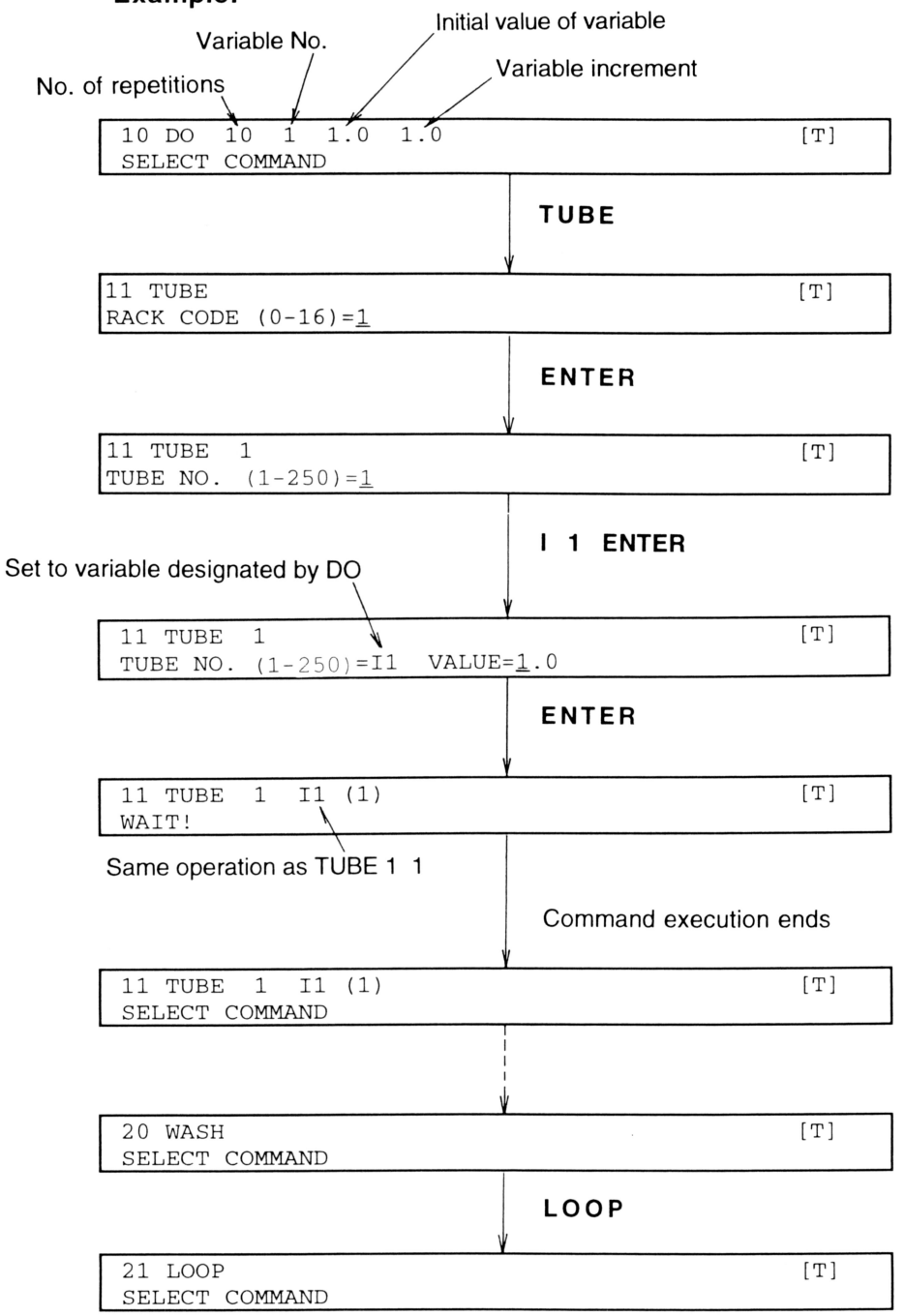
3. How to Designate a Variable

You can designate a variable as a command parameter.

Press **I**, then key in a number from 1 to 20, and finally press **ENTER**.

Now a prompt "VALUE=" appears. Key in the initial value of the chosen variable. If you do not need to alter the initial value, press **ENTER**.

Example:



When you execute the above program, the analysis proceeds in order from TUBE 1 1 → TUBE 1 2 →... →TUBE 1 10

Notes:

1. You can not designate a variable for the first parameter (number of repetitions) or for the second parameter (variable number) of the DO command. You can only designate a value.
2. If you enter the same variable two or more times, the operation may not agree between the teaching and the program execution modes. After executing the program, the value set last by the program becomes the initial value of the variable.

4. If an Error is Generated

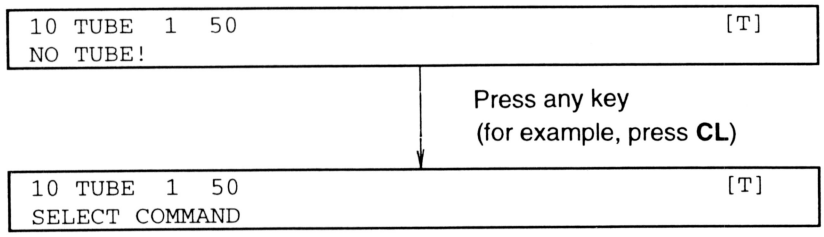
If an error message appears while creating a program in the TEACH mode, press any key. For example, press **CL** key.
If a parameter range error message occurs, you may continue creating the program without exiting from the TEACH mode by pressing **CL**.

Error Message	Meaning
ERROR-PARAMETER!	You entered a parameter that is beyond the autosampler operational range.
NO TUBE!	You moved the needle through the TUBE command to a position where there is no vial. Pressing **CL** will let you continue defining steps in this program.

The task cannot continue if the error indicates either a mechanism operation error, or a program registration area overflow. Pressing any key resumes the programming initial display. However, the unit registers the program steps entered prior to the error.

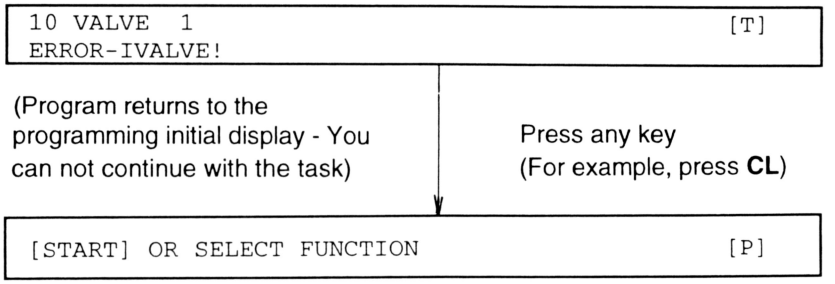
Examples :

1. There is not a tube at RACK CODE = 1, TUBE NO. = 50.



(Task can continue.)

2. The injection valve does not operate correctly.



1.4.2 Editing the Program through the EDIT Function

Use the **EDIT** function to edit a program that is present in the editor buffer. Editing can involve command alteration, insertion, deletion, addition or change in the initial value of a variable (I1-I20).

1. Operating Procedure

1a. Press **EDIT** on the programming mode initial display to access the EDIT initial display (Figure 1-4)

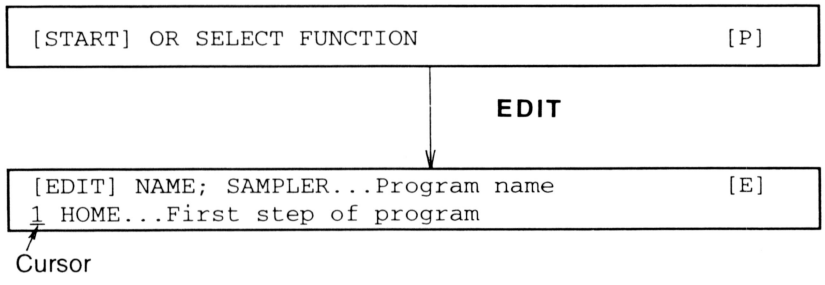
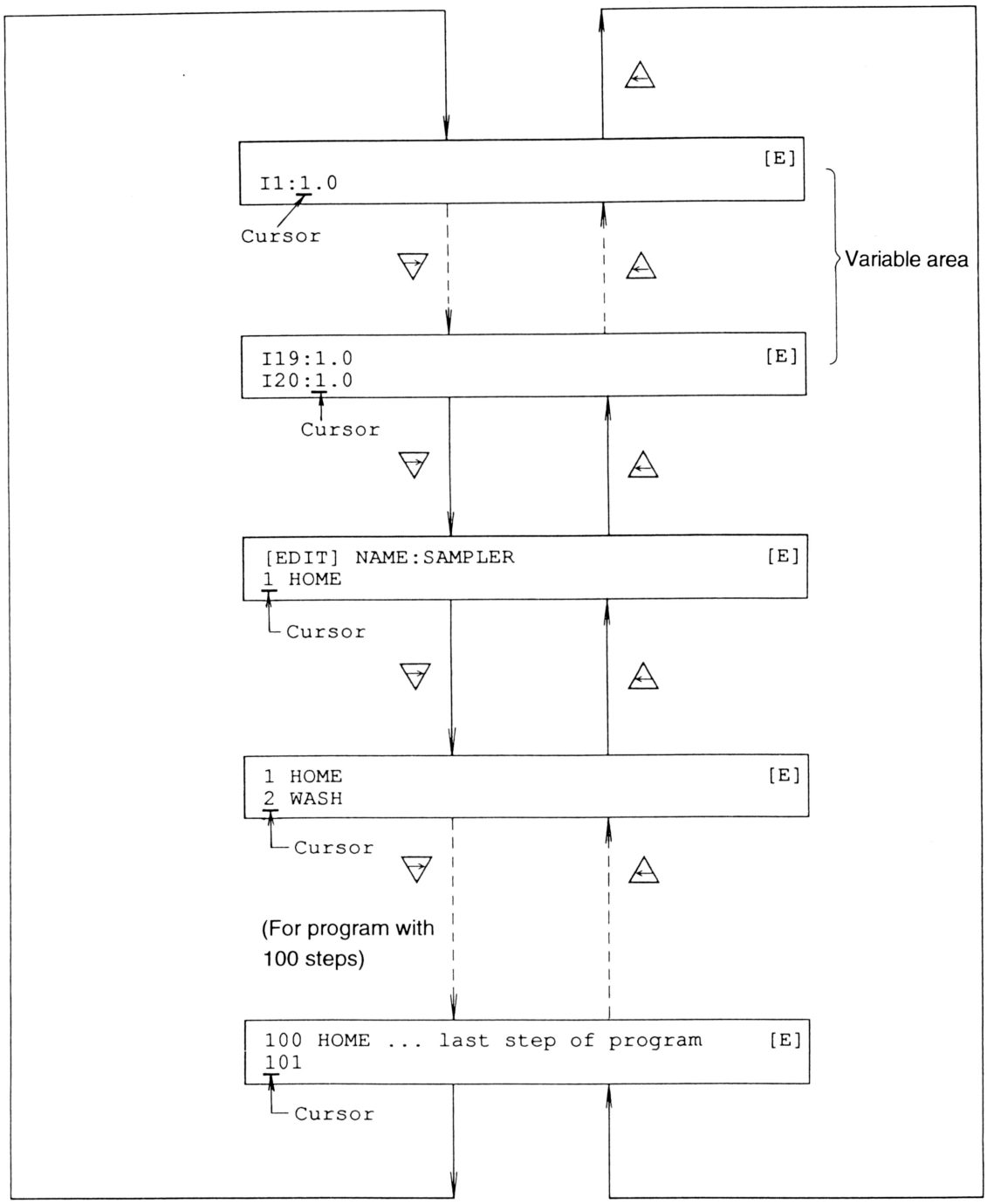


Figure 1-4 EDIT Mode Initial display

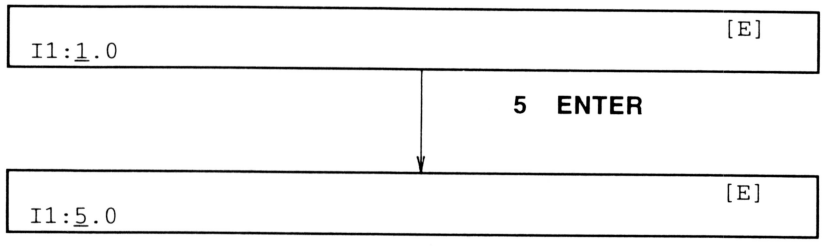
1b. Use ◁ or ▽ to move the cursor to a variable or a command. On the EDIT mode initial display, pressing ◁ moves the cursor to the variable area and pressing ▽ moves the cursor to a higher step No. of the program.
If you press ◁ or ▽ , it will continue to move the cursor. Pressing ◁ moves the cursor from the variable area to the last step of a program and pressing ▽ moves the cursor to the last step of a program and back into the variable area.


[E]
I1:1.0
Cursor
Variable area
I19:1.0
I20:1.0
[E]
Cursor
[EDIT] NAME:SAMPLER
1 HOME
[E]
Cursor
1 HOME
2 WASH
[E]
Cursor
(For program with
100 steps)
100 HOME ... last step of program
101
[E]
Cursor

1c. (Initial value setting for a variable)

After moving the cursor to an intended position by using either ◁ or ▽ keys, use the numeric keys to set an initial variable value.

Example: To change the initial value of I1 from 1.0 to 5.0.



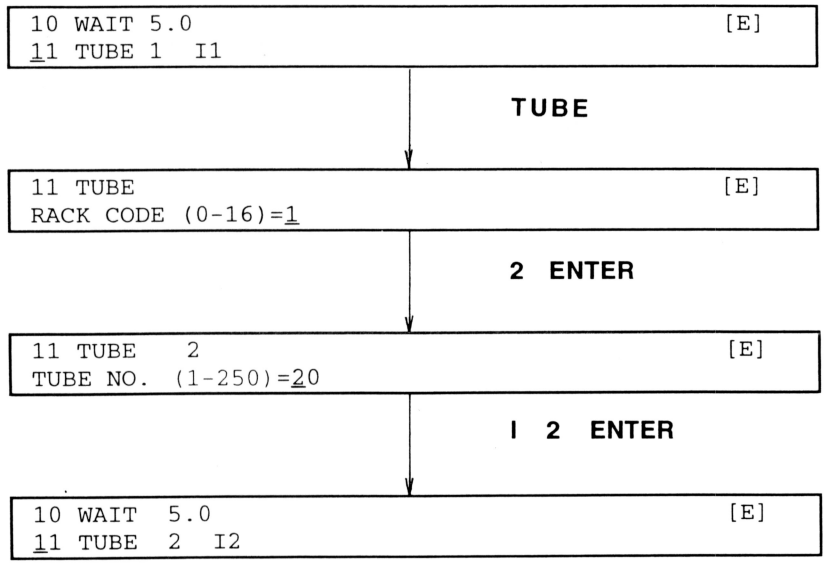
(The initial value of a variable can be set down to the 1st digit past the decimal point within the range of 0 to 99999.9.)

1d. (Program edit)

Use the ◁ or ▽ keys to move the cursor to the program step number you want to edit. Use the program command keys, **INSERT** and **DELETE**, to edit the program.

(1) To alter a command

Example: To alter TUBE 1 I1 to TUBE 2 I2 in program step 11)

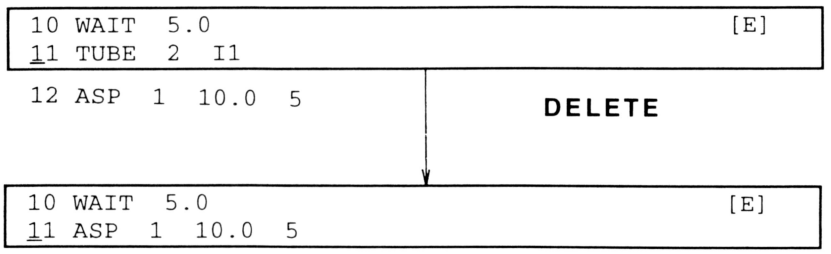


(2) To delete a command

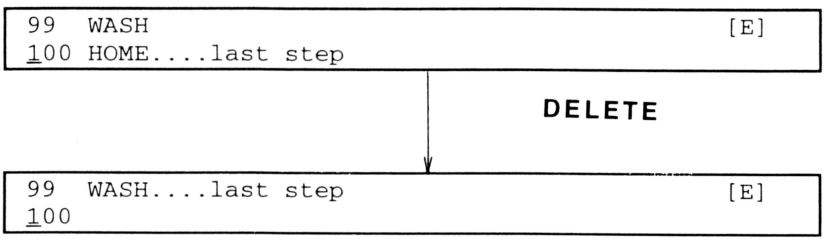
Use the △ or ▽ keys to move the cursor to a step number and press **DELETE**. You will delete the command at the step number where the cursor is. The command of the following step is pulled up and will be displayed. You can press **DELETE** several times. Each time you press **DELETE**, you erase the step where the cursor is resting.

Examples:

1. Deleting TUBE 2 I1 of step 11



2. Deleting the last step of a program having 100 steps.

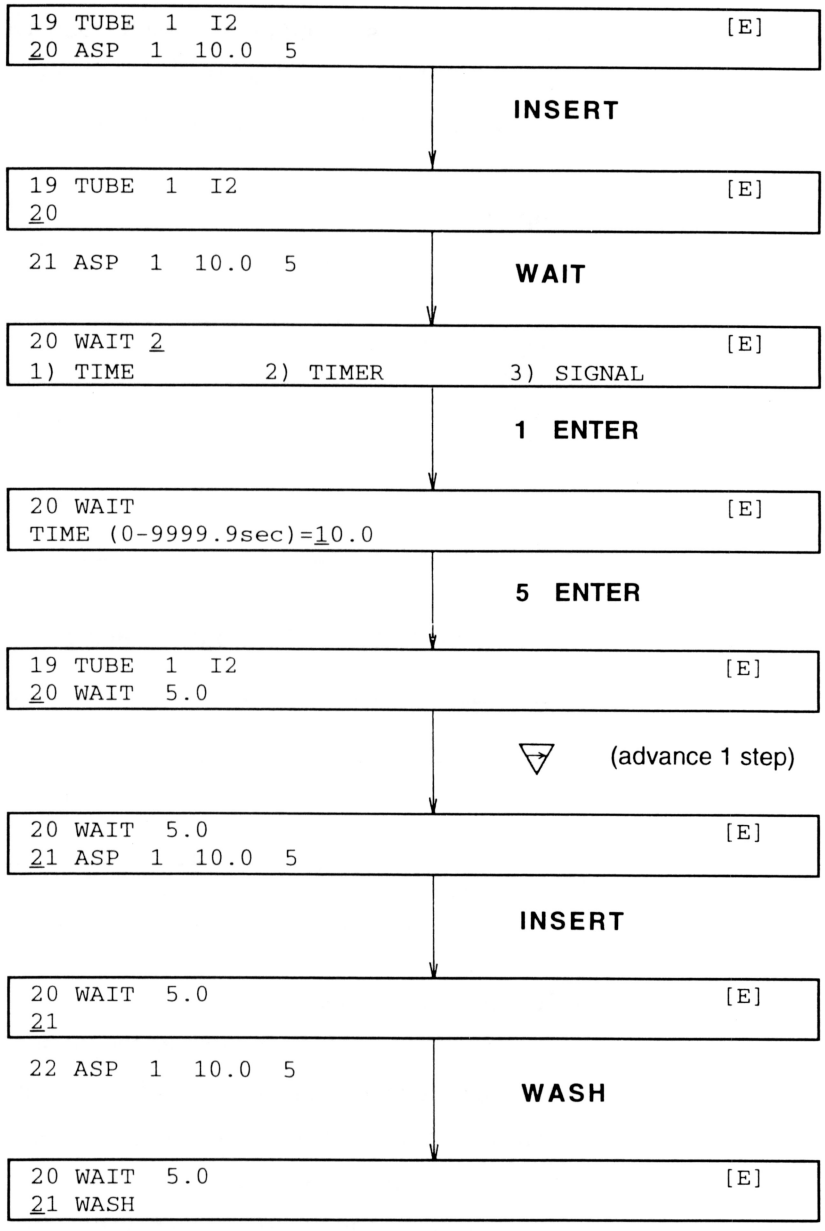


(3) To insert a command

Use the △ or ▽ keys to move the cursor to the step number you want and press **INSERT**. The second line of the LCD becomes blank and all command steps including the one where the cursor was resting move down by one line. Use a program command key to enter a new program command in the blank line.

Example:

Insert a WAIT 5.0 command and a WASH command between step 19 (TUBE 1 I2) and 20 (ASP 1 10.0 5).



Pressing **DELETE**, while inserting a command, brings back the display which was present before you pressed the **INSERT** command.

(5) To add commands after the last step of a program

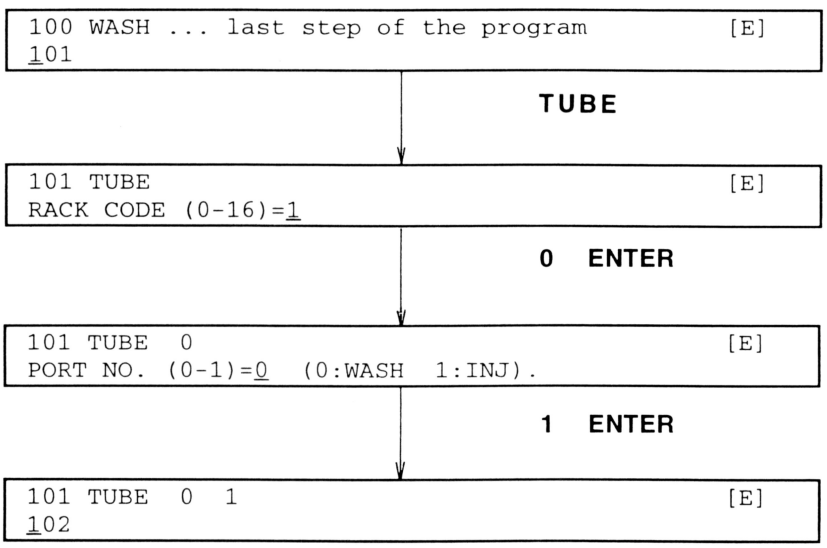
Use the △ or ▽ keys to move the cursor to the last program step. The last step will show on the top line of the LCD. Using the program command keys, enter the commands you want to add after the top line is displayed.

(Adding a command after the top line accesses a display where you can add the next command.)

Even when there is not a command in the program area, you can enter commands as shown before.

Example:

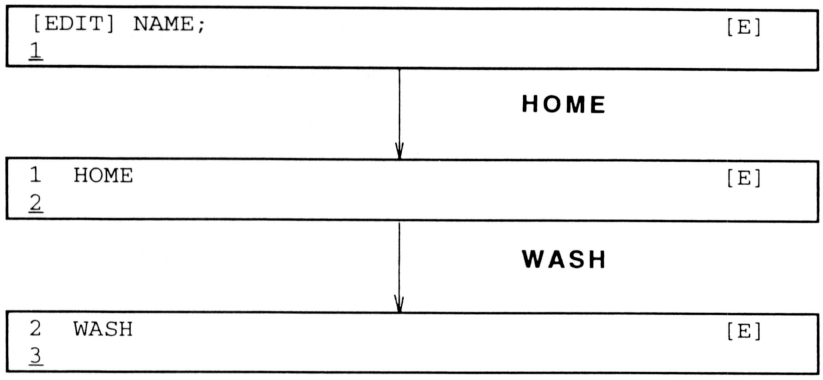
1. Adding a command below the last step of a 100 step program (for example, adding TUBE 0 1: moves the needle to the injection port.)



After the first addition, you can add another command.

2. Creating a program by starting at the first step.

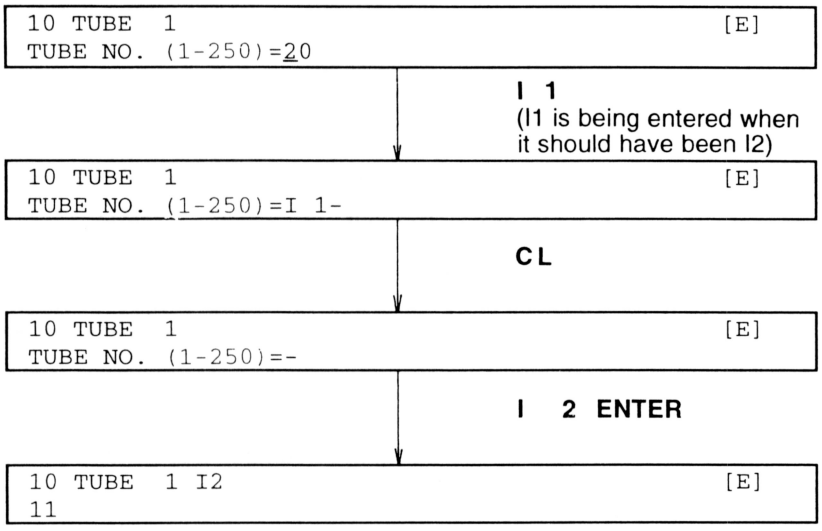
   (Display when there is not a command in the program area)



You can now add commands in order

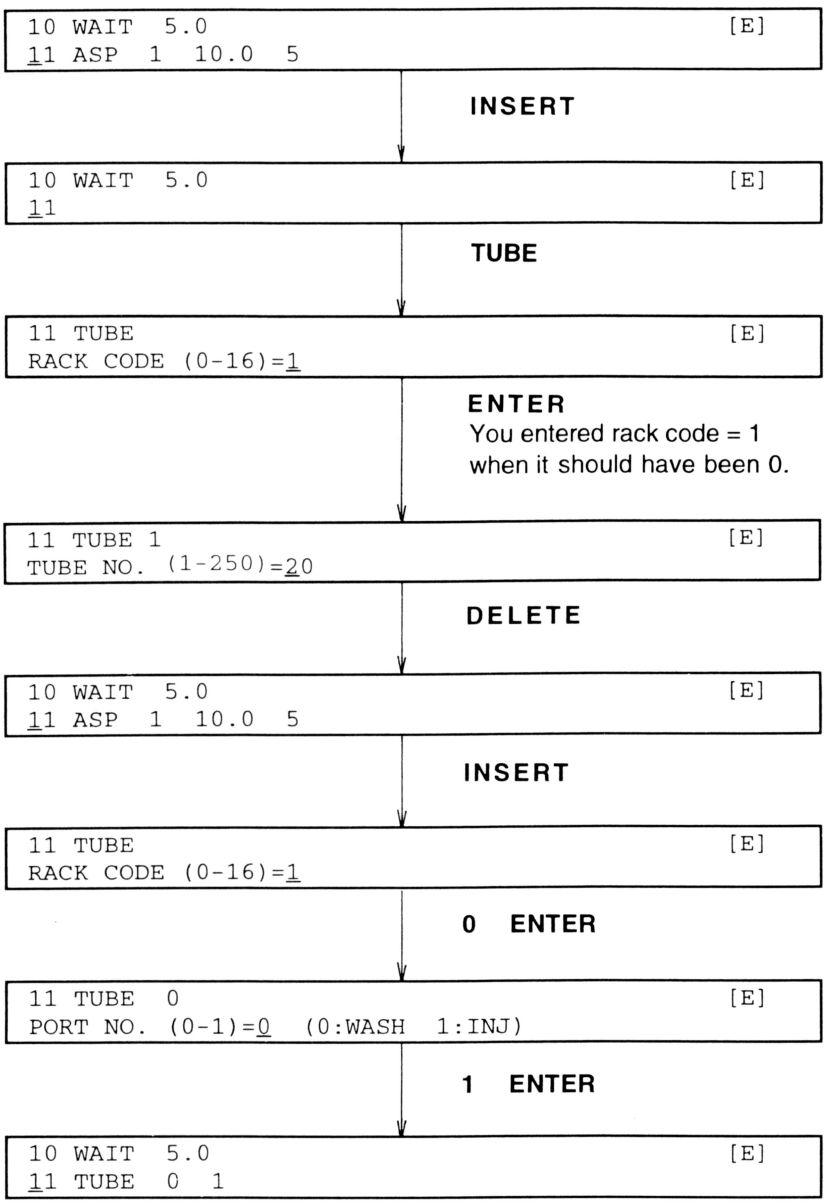
1e. If you decide to alter a parameter while entering it (i.e. before pressing **ENTER**), press **CL** and enter the correct parameter.

Example:



If you want to correct a parameter after pressing **ENTER**, press **DELETE**. This deletes the command input in progress. The display shows either the screen or the status that was present before you pressed the command. For example, you decide to correct the line you inserted. Press **DELETE** and the line which had moved down reappears. At this point, you can take whatever action you want to perform next.

Example:



1f. After you edit the program and you enter the initial value of the variable, press **ESCAPE** to return from the EDIT mode to the programming initial display.

The editor buffer does not register any command being defined for which you have not pressed the **ENTER** key.

1g. Press **START** to execute the program. If the results you obtain are not satisfactory, press **EDIT**, correct the program and reexecute it.

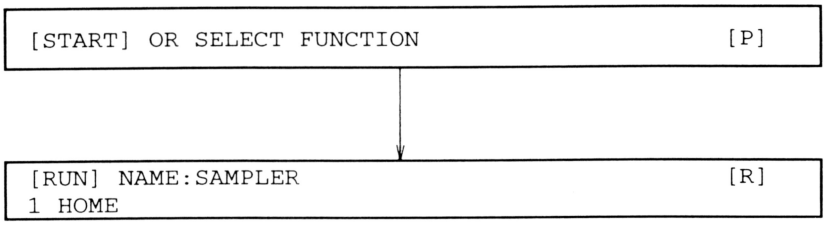
1h. When the results are satisfactory, press **FILE** and use the SAVE function to store the program in a file.
(The program in the editor buffer is protected by the unit´s battery. The program is not erased if you turn the power off.)

1.5 Program Execution

1. Program Execution

The following section explains the execution of a program you can create by using the TEACH or the EDIT function or one you can load from a file by using the LOAD function (see Section 1.6.2).

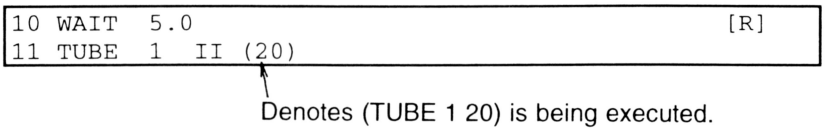
1a. Press **START** while on the programming mode initial display. The program execution starts and the step number and command under execution appear in succession in the LCD.



Pressing **START** displays the first step of the program. As the program runs, you will see each step of the program.

1b. When you designate a variable (I1-I20) as a command parameter and monitor the display, the display shows the contents of the variable. When an integer parameter is in effect, the display truncates the numbers after the decimal point.

Example: When the contents of variable I1 are 20.5



1c. When the program reaches the last step, the execution ends and the programming mode initial display appears again. After execution, the initial value of the variable (I1-I20) resets to the value it had before execution.

1d. While running a program, press **STOP** to cancel the program execution.

The programming mode initial display appears again.

If you press **STOP** while executing ASP, DISP, TUBE or any other of the mechanism controlling commands, the program execution cancels after completion of the relevant command task.

2. If an Error Occurs

If an error occurs while executing a program, the command causing the error shows on the first line of the LCD and the error message on the second line. The program execution stops.

Example:

Tube No. = 50 for rack code = 1 is not correct. It is beyond the movable range of the needle. ($0 \leq x \leq 156.0$ mm, $0 \leq y \leq 156.0$ mm)

```
51 TUBE  1  50                                    [R]
ERROR-PARAMETER!
```

Press any key. For example press **CL**. The programming mode initial display will reappear. Remedy the cause of the error and then execute the program again.

1.6 File Operation

Any time you create a program by using the TEACH or EDIT function, you can save it in a file by using the **FILE** key. You can load any program saved in a file into the edit or buffer. Besides file saving and loading, you can implement other file operations such as listing (DIRECTORY), and deleting (DELETE). In addition, you can condense the distributed vacant areas (CONDENSE).

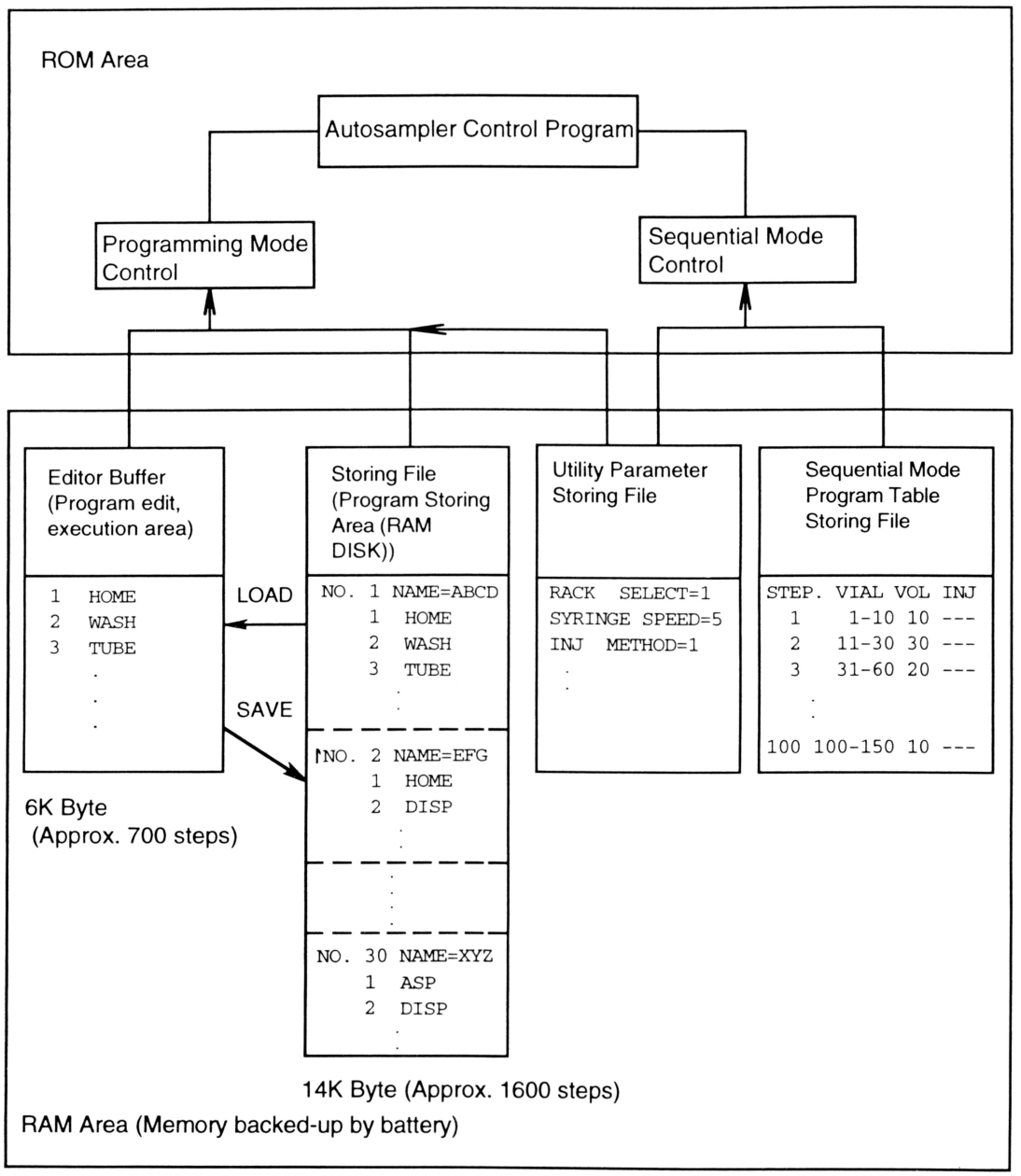
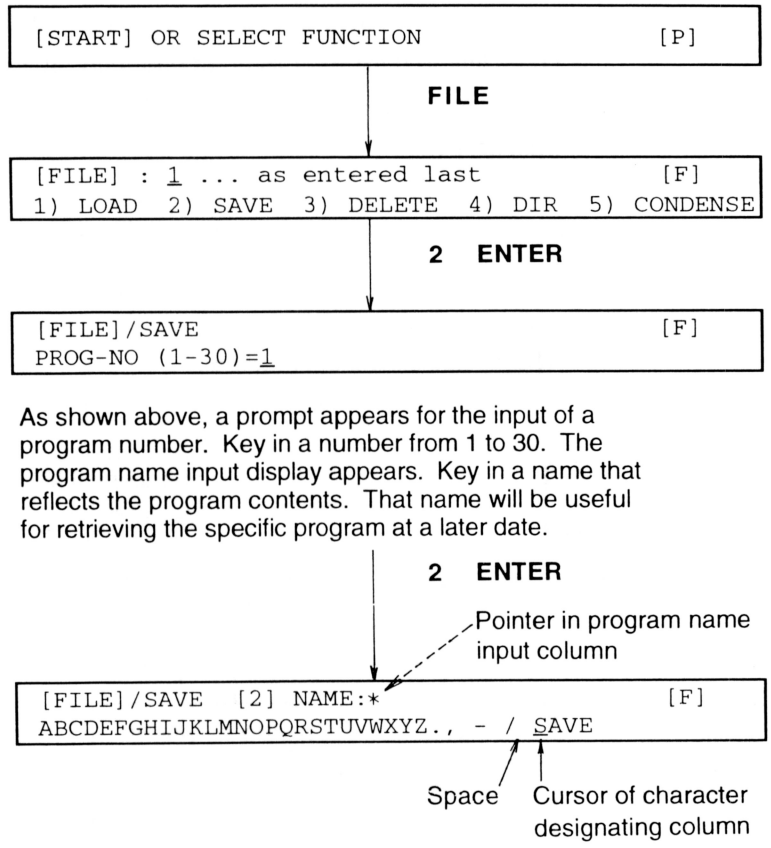


Figure 1-5 L-7250 Memory Structure

1.6.1 Program Save and Name Input

Press **FILE** and key in **2 ENTER** to select the SAVE function. Do this while in the programming mode initial display.

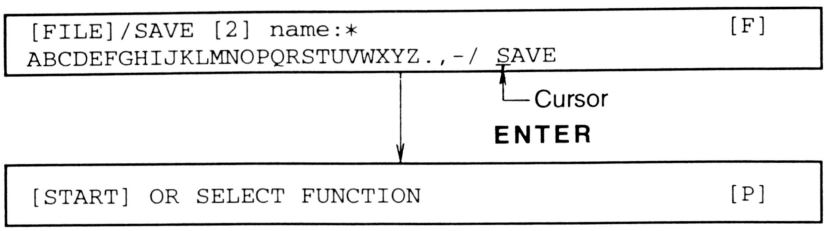


Use the ◁ or ▽ keys to move the cursor to the character you want and press **ENTER**. The cursor moves to SAVE by pressing the ◁ key when at the A character. The cursor moves to A by pressing ▽ when at SAVE. Enter the numbers (*0 to 9) by pressing the numeric keys.
You do not need to press **ENTER**.

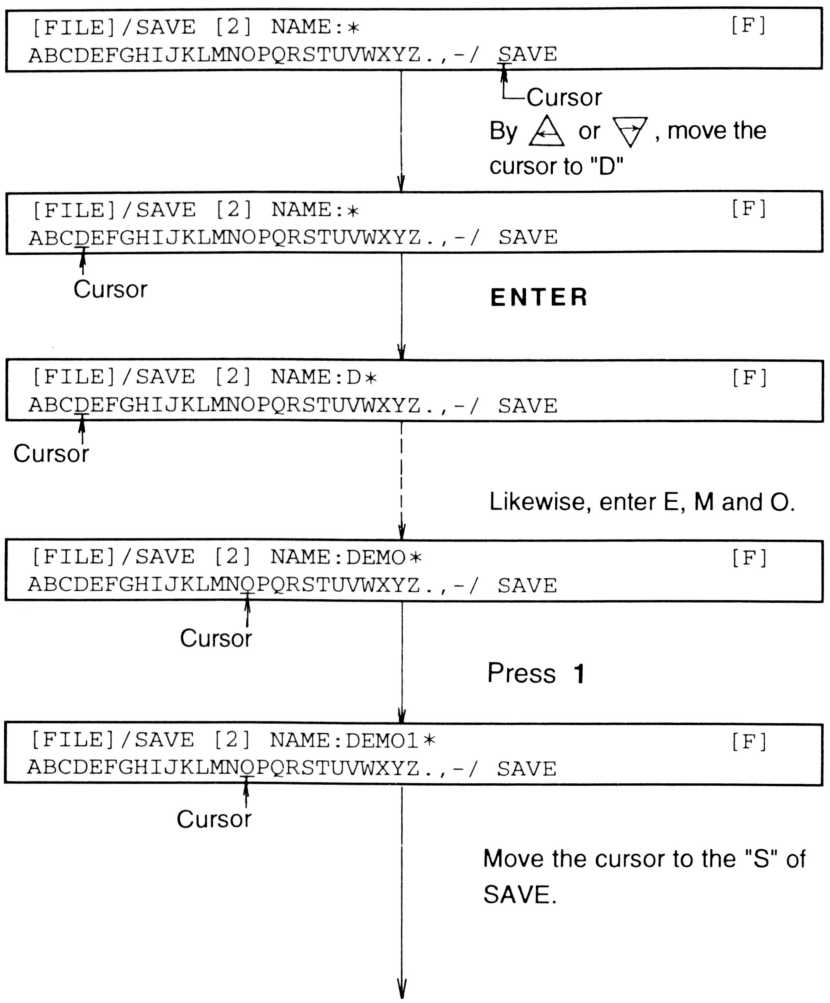
After you complete defining the name characters, move the cursor to the "S" of SAVE and press **ENTER**. You will save the program with the chosen name. You can use up to 10 characters for the program name. However, entering a name is optional. The following examples show the two options.

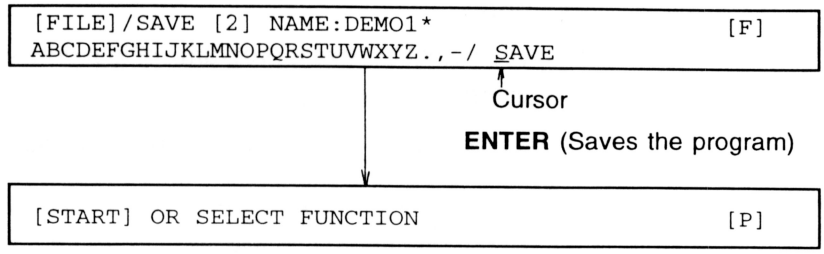
Example:

1. If you select to save a program without entering a name, press **ENTER** when the cursor is at SAVE. After saving the program, the programming mode initial display reappears.



2. When you choose to name a program and save it, enter each character of the name as shown next and press **ENTER** when the cursor is at SAVE. The example uses the name DEMO1.





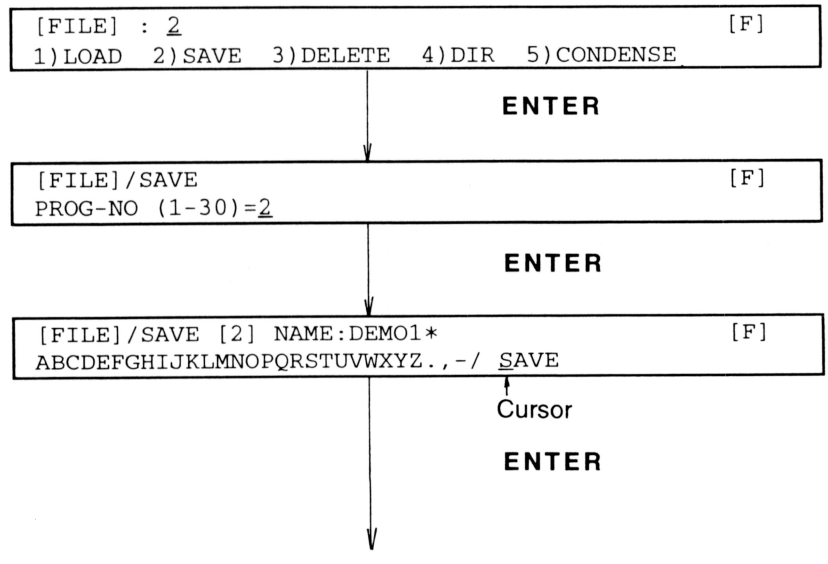
Notes:

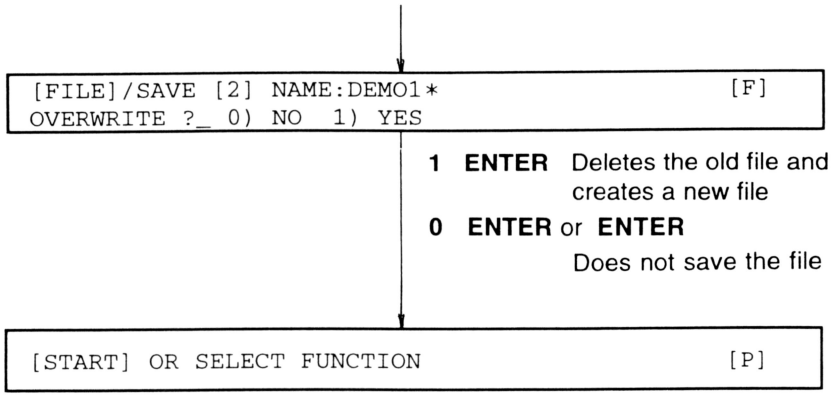
1. The cursor moves continuously when you hold down the ◁ or ▽ keys.
2. If you make a mistake midway through the name, press **CL** and select the correct character.

Once you enter the program name, it is stored in the buffer memory until you delete the program by either pressing the **TEACH** key or by loading another program through the LOAD function.
If you LOAD another program and again select the SAVE function, the display shows the program name you have chosen last. If you do not want to rename the program, press **ENTER**.

Example:

To alter part of a program and to save it with the same name but under a different program number (For example, program number = 2), do the following:





If you try to save a file with a name that already exists, a message appears asking you whether or not to overwrite the program. The choices are:

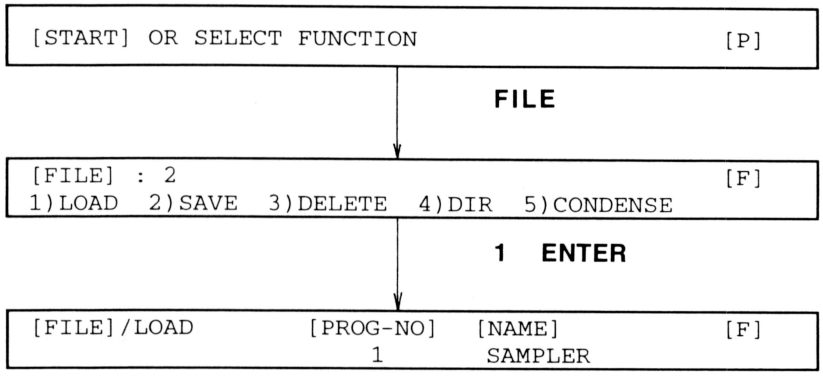
YES (**1** **ENTER**) : Deletes the old file and creates a new file (overwrites)

NO (**0** **ENTER** or **ENTER**) : Does not save the file.

To rename a program, press **CL** to erase the current name. Then, enter the new name.

1.6.2 Program Loading

To load a program, be sure that you are at the programming mode initial display. Then, press **FILE** and key in **1 ENTER** to select the LOAD function.

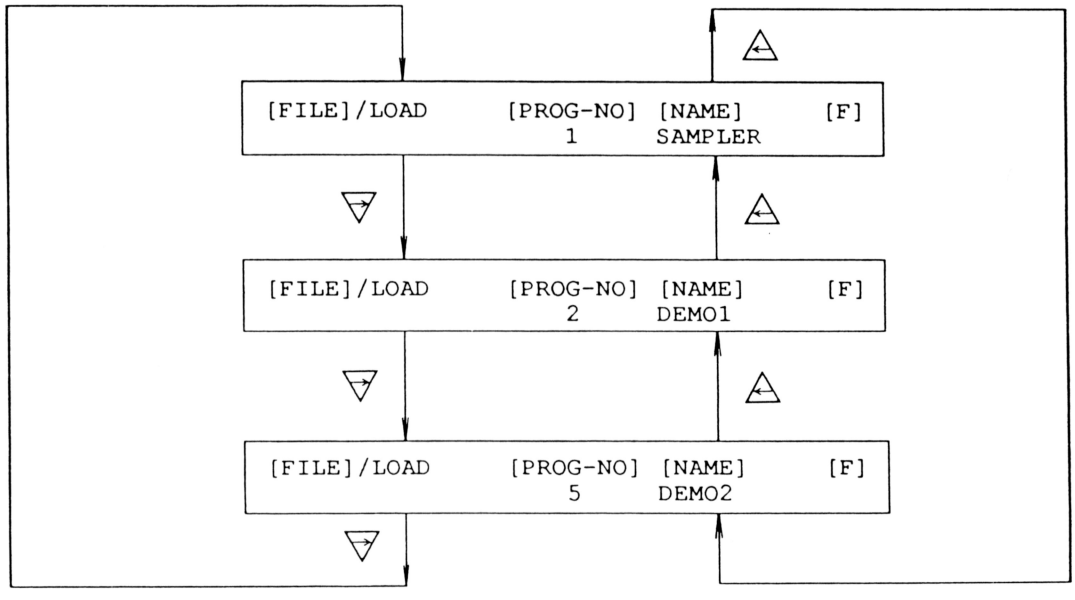


Observe that a display of all programs that have been saved begins by showing the lowest program number and its name (if one was entered). The name field will be blank if you did not enter a name when you saved the program.

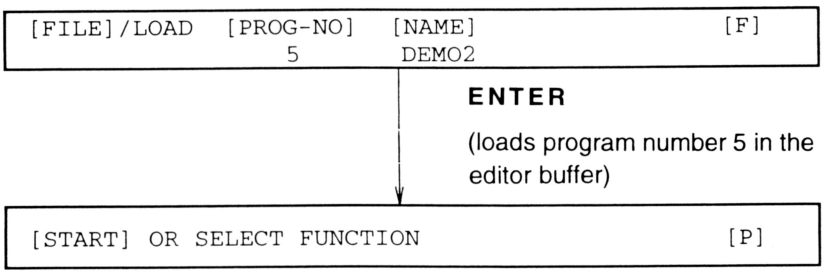
To load a program in the editor buffer, press the △ or ▽ keys to search for a program and then press **ENTER**. A particular program number does not show if you did not designate that particular program number when saving programs.

Example:

1. This example shows how to use the △, ▽ keys to search for programs when program numbers 1, 2 and 5 were saved.



2. Load a program number = 5 (DEMO2)



(The programming mode initial display reappears.)

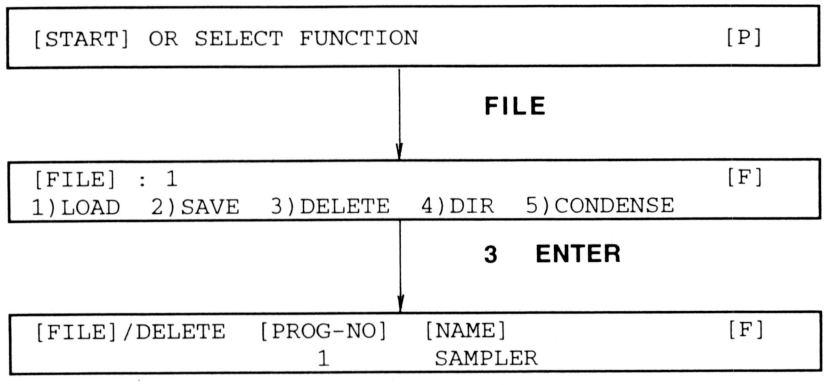
Notes:

1. Pressing **ESCAPE** midway through a program search brings back the programming mode initial display.
2. Holding down the △ or ▽ keys while searching for a program makes the search operation continuous.

1.6.3 Deleting a File

Use this function to delete unnecessary files (programs) and to secure a vacant area.

Press **FILE** and key in **3** **ENTER** to select the DELETE function. Do this while in the programming mode initial display.



As shown above, the lowest program number and its name appear. A name will only show if you entered a name when you saved the program. If you did not enter a name, the name field will be blank. Press the ◁ or ▽ keys to search for the program you want to delete.

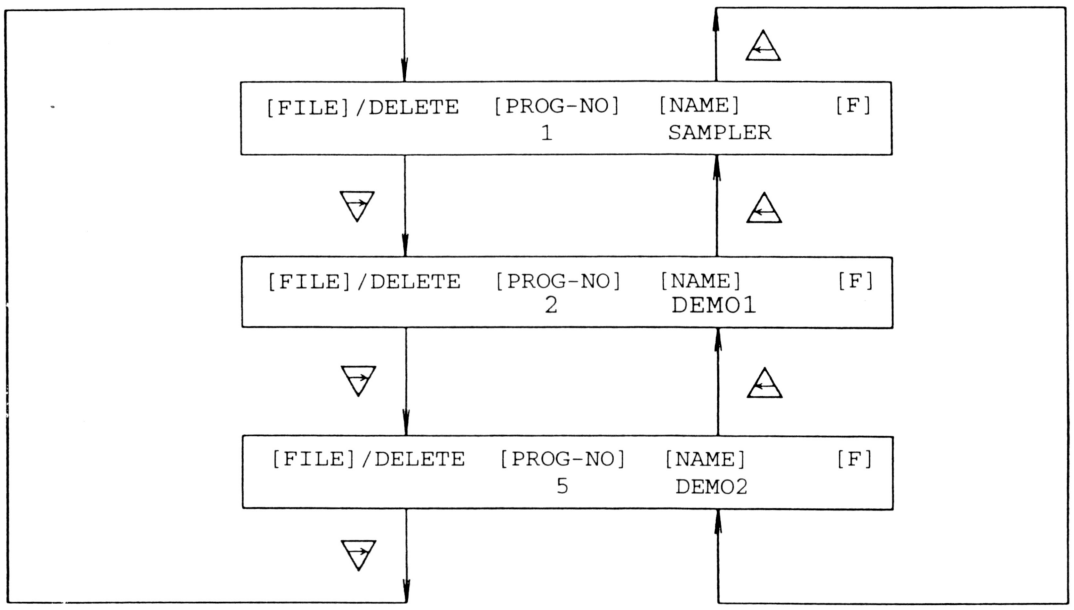
Pressing **ENTER** displays a prompt "DELETE ? 0) NO 1) YES".

YES (**1** **ENTER**) : Deletes the program

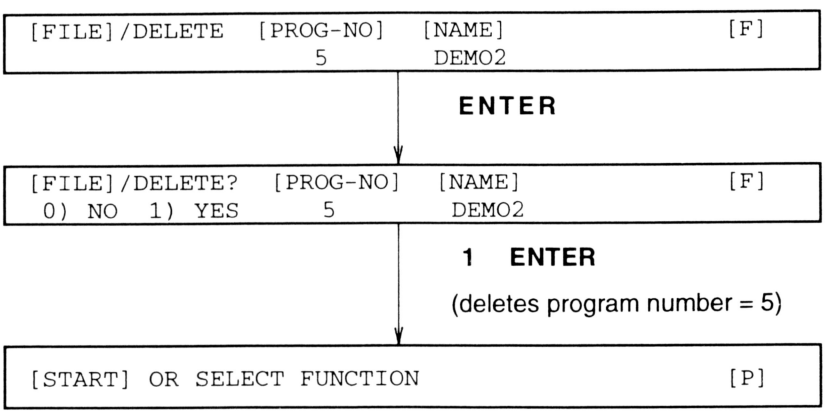
NO (**0** **ENTER** or **ENTER**) : Does not delete the program.

Example :

1. In this example you will use the △ , ▽ keys to search for program numbers 1, 2 and 5 that were filed.



2. In this example, you will delete program number 5 named DEMO2.



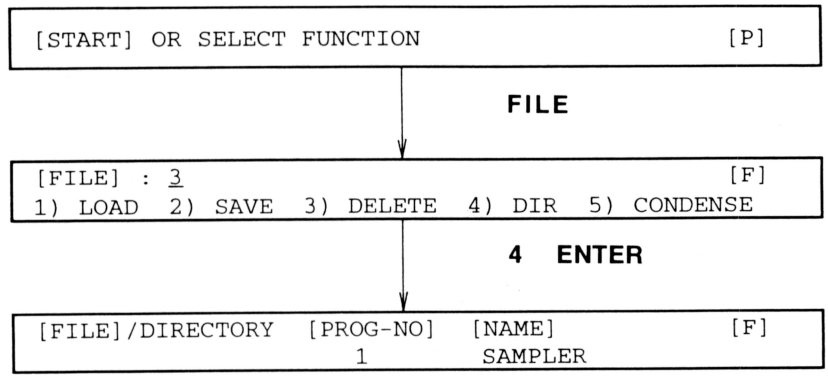
(The programming mode initial display resumes.)

Notes:

1. Pressing **ESCAPE** midway through the above operation brings back the programming mode initial display.
2. The above search operation is continuous when you hold down the △ or ▽ keys.

1.6.4 What Programs are Filed?

DIRectory displays the names of the programs that are saved. Press **FILE** and key in **4 ENTER** to select the DIRectory function and obtain the program listing. Do this while in the programming mode initial display.



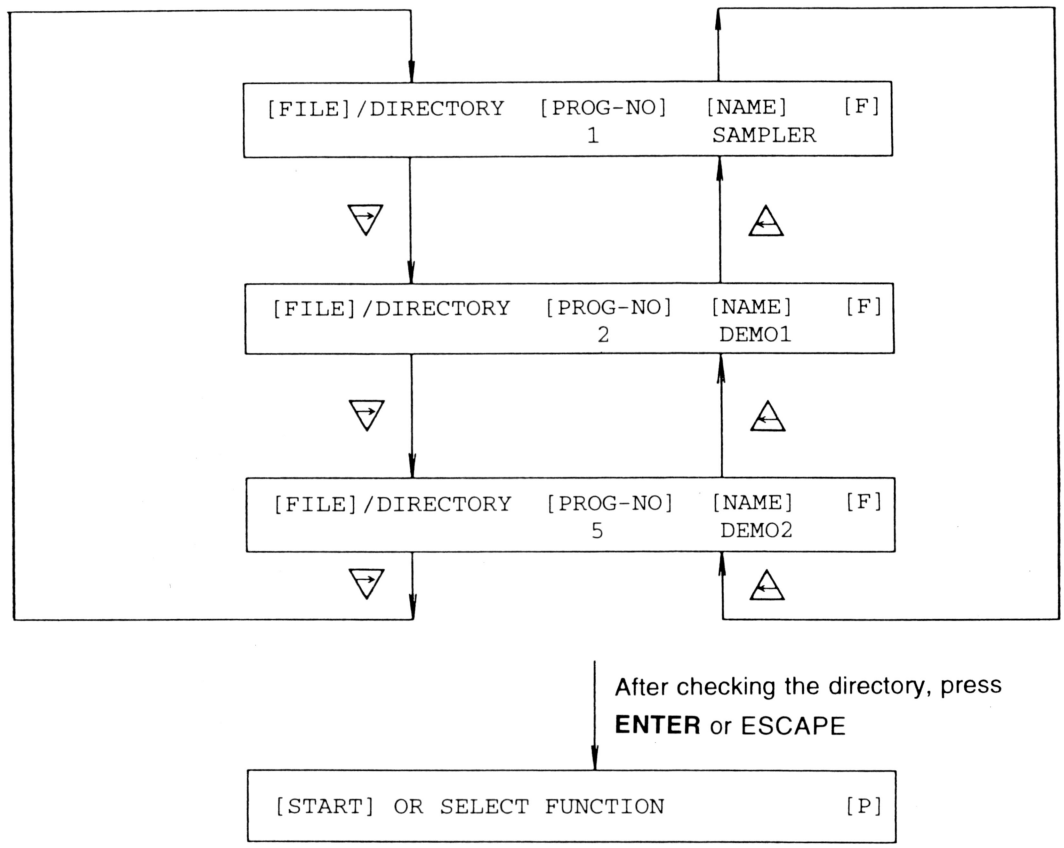
Observe that the lowest program number and the name of the programs in storage will appear. If you did not enter a name when the program was saved, the name field will be blank.

Press the △ or ▽ keys to check for the program numbers and names currently filed.

Press **ENTER** or **ESCAPE** to bring back the programming mode initial display.

Example:

1. In this example we will show use of the △ , ▽ keys to obtain the directory when program numbers 1, 2 and 5 are on file.



(The programming mode initial display appears.)

Note: The search operation continues while you hold down the △ or ▽ keys.

1.6.5 Condensing of Distributed Vacant Areas

As you save and delete programs repeatedly, you create many vacant file areas in the memory. When there are vacant areas, the open space may not be available and you may not be able to save a program from the editor buffer. The CONDENSE function combines all the distributed vacant areas into one block which now can be used to store programs.

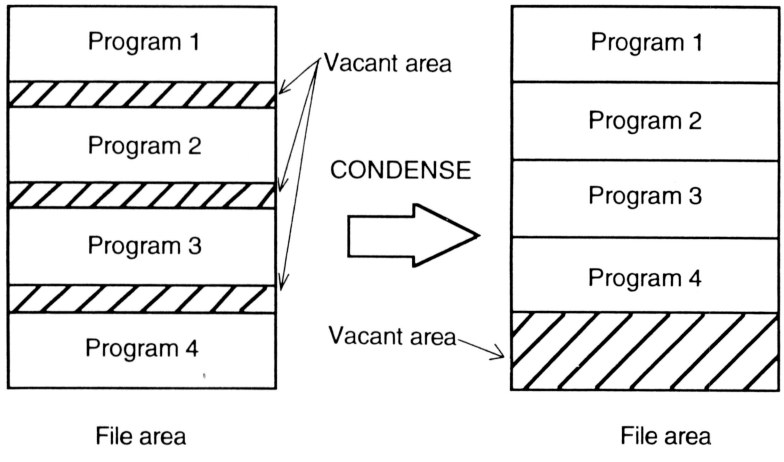
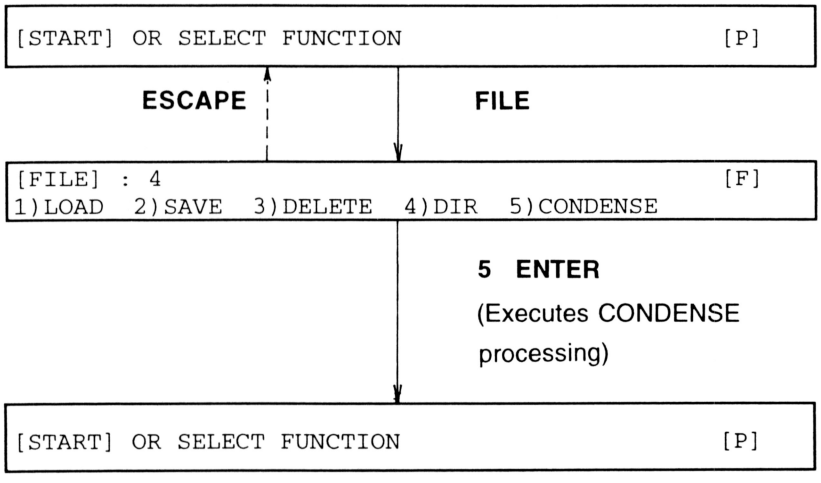


Figure 1-6 Condensing of Vacant Area

Press **FILE** and then key in **5** and **ENTER** , to execute the CONDENSE operation. Do this while in the programming mode initial display. At the conclusion of the condensing operation, the initial display reappears.



1.7 Examples of Programs

The following program shows the automatic sample preparation and injection of 32 samples. Each sample analysis time is 10 minutes. Sample preparation consists of several steps. First, add reagent 1 into the sample solution vial, and allow it to react for a certain time. Then, add a second reagent to the same vial, and again allow it to react for some time. Finally, have the autosampler inject the prepared samples.

1.7.1 Processing Sequence

(1) Set the needle and other mechanism to the home position and do a washing.

(2) Measure reagent 1 and the sample and dispense them to the reaction vial (tube).
Reagent 1 : 400 µl
Sample : 10 µl

(3) Stir.

(4) Wait for the reaction to occur.
Wait time : 5 min

(5) Measure reagent 2 and dispense it into the reaction vial (tube).
Reagent 2 : 400 µl

(6) Stir.

(7) Wait for the reaction to occur.
Wait time : 2 min

(8) Place the prepared sample in the autosampler injection port and inject.
Injection volume: 30 µl

(9) Start an analysis.

(10) Wash the needle, syringe and injection port and wait for the analysis to end.
The analysis time is 10 minutes.

(11) Carry out steps (2) through (10) for all samples.

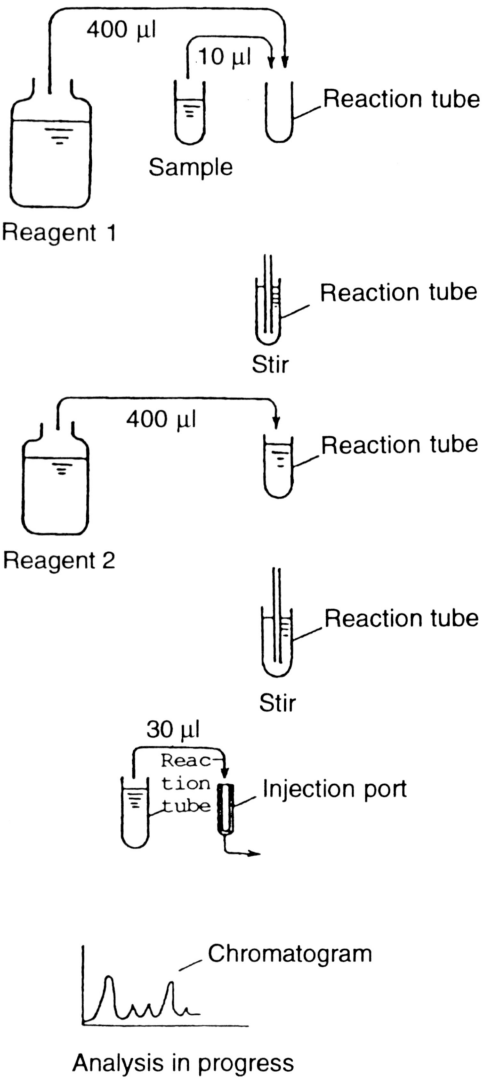
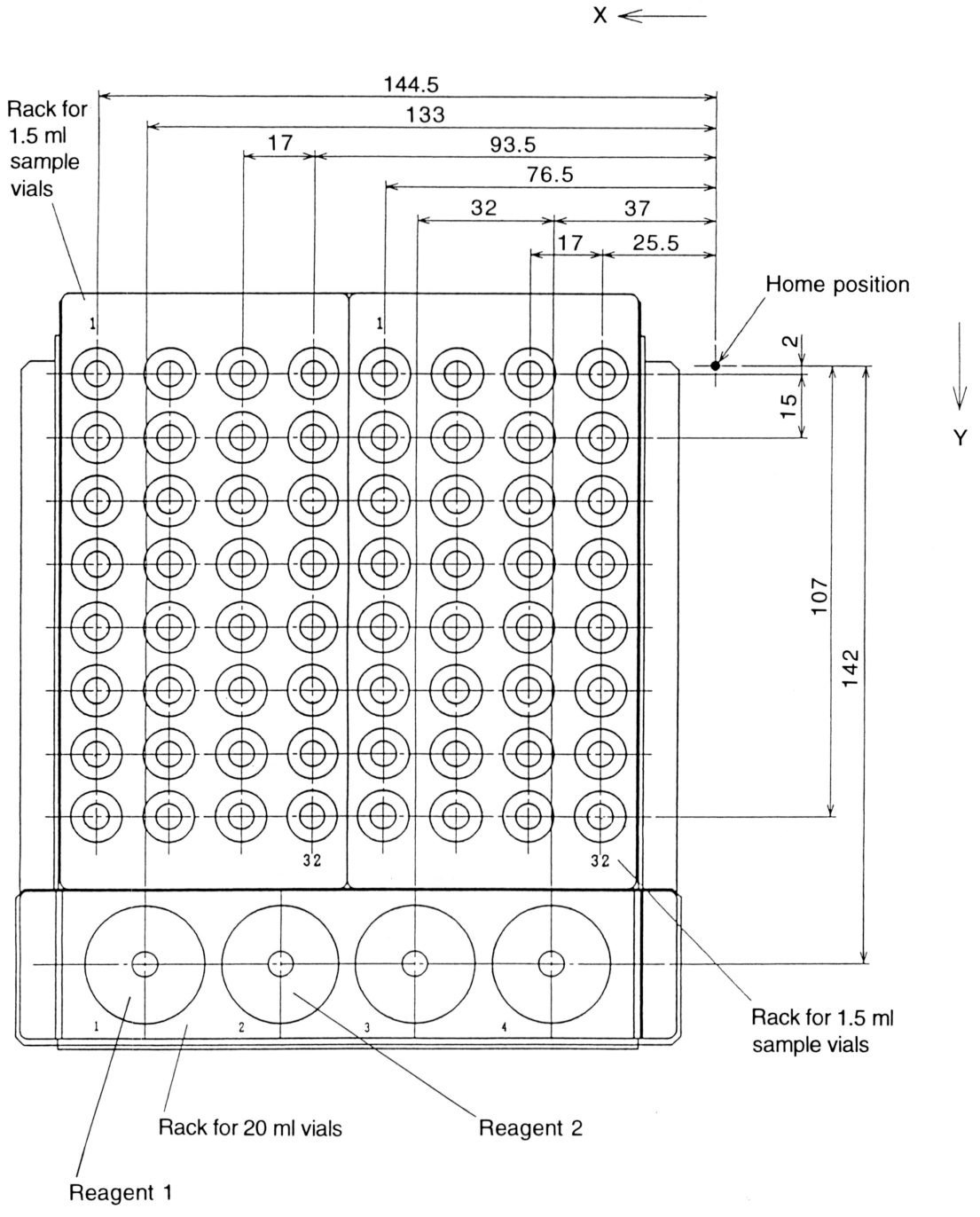


Figure 1-7 Processing Sequence

1.7.2 Location of Reagents 1 and 2, Samples and Reaction Vials



(Dimensional unit: mm)

1.7.3 Parameter Setting

1. Rack Parameters

Place the samples in the sample rack. Enter rack parameter = 2 for the sample rack. Place the reaction vials (tubes) in the reaction vial rack. Enter rack parameter = 3 for the reaction vial rack. The rack parameters are set by the UTILITY function.

For example, you could set the following parameters.

Rack Code	X1	X2	Y1	Y2	Z	Nx	Ny	P
2	25.5	76.5	2.0	107.0	36	4.0	8.0	1
3	93.5	144.5	2.0	107.0	36	4.0	8.0	1

Note: When using the TUBE command, you must use the rack parameters that match the rack you are using.

Use the MOVE command to place the needle at reagent 1 and 2.

2. Others

(a) Number of washings : 3

(b) Number of dilutors : 1

(c) Syringe capacity : 500 µl (Code 2)

1.7.4 Example of a Program

[Line No.]	[Command]						
1	HOME					Sets the needle, plunger and other mechanism to the home position and does a wash.	
2	WASH						
3	DO 32	1	1.0	1.0		(DO 32 TIMES I1←1.0 step=1.0) Repeats the process of lines No. 4 to 94 for 32 times.	
4	HEIGHT	0.0	2			Aspirates 5 µl of air.	Aspiration of reagent 1
5	ASP 1	5.0	5				
6	WAIT	1.0					
7	MOVE	133.0	142.0	57.0		Moves the needle to the vial holding reagent 1.	
8	ASP 1	450.0	5			Aspirates 450 µl of reagent 1.	
9	WAIT	1.0					
10	HEIGHT	0.0	2			Aspirates 5 µl of air.	
11	ASP 1	5.0	5				
12	WAIT	1.0					
13	TUBE	0	0			Places the needle in the washing port and washes its outside.	
14	TUBE	2	I1			Moves the needle to sample No.=I1	Sample aspiration
15	ASP 1	10.0	5			Aspirates 10 µl of sample.	
16	WAIT	3.0					
17	HEIGHT	0.0	2			Aspirates 5 µl of air.	
18	ASP 1	5.0	5				
19	WAIT	1.0					
20	TUBE	3	I1			Moves the needle to reaction vial (tube) No.=I1.	Dispenses sample and reagent 1
21	DISP	1	420.0	5		Dispenses sample (10 µl) + Reagent 1 (400 µl) + air (10 µl).	
22	WAIT	1.0					

[Line No.]	[Command]					
23	HEIGHT	0.0	2			Aspirates 30 µl of air.
24	ASP 1	30.0	5			
25	WAIT	1.0				
26	TUBE	3	I1	.....		Again places the needle in the reaction vial (tube).
27	DO 3	2	1.0	1.0	.....	(DO 3 TIMES I2 ←1.0 step=1.0) repeats 3 times the process of lines No. 28 to 32.
28	ASP	1	300.0	5		Repeats the process of aspirating and dispensing sample and reagent 1 into the reaction vial (tube). This process mixes the sample and reagent.
29	WAIT	1.0				
30	DISP	1	300.0	5		
31	WAIT	1.0				
32	LOOP					
33	TIMER	300.0				Sets the timer to 5 min.
34	HEIGHT	0.0	2			Aspirates 5 µl of air into the end of the needle.
35	ASP 1	5.0	5			
36	WAIT	1.0				
37	WASH	.....				Washes the needle, syringe and injection port.
38	WAITTIMER					
39	HEIGHT	0.0	2			Aspirates 5 µl of air into the end of the needle.
40	ASP 1	5.0	5			
41	WAIT	1.0				
42	MOVE	101.0	142.0	57.0		Moves the needle to the vial holding reagent 2.
43	ASP 1	450.0	5			Aspirates 450 µl of reagent 2.
44	WAIT	1.0				
45	HEIGHT	0.0	2			Aspirates 5 µl of air into the end of the needle.
46	ASP 1	5.0	5			
47	WAIT	1.0				

Mixing

Waits for the reaction time to occur (5 minutes)

Aspiration of reagent 2

[Line No.]	[Command]		
48	TUBE 3 I1	Moves the needle to reaction vial (tube) No. I1.	Dispensing reagent 2
49	DISP 1 405.0 5	Dispenses reagent 2 (400 µl) + air (5 µl)	
50	WAIT 1.0		
51	HEIGHT 0.0 2	Aspirates 30 µl of air into the end of the needle.	Mixing
52	ASP 1 30.0 5		
53	WAIT 1.0		
54	TUBE 3 I1	Again places the needle in the reaction tube.	
55	DO 3 2 1.0 1.0	(DO 3 times I2 ←1.0 step=1.0) Repeats 3 times the process of lines No. 56 to 60).	
56	ASP 1 400.0 5	Repeats the process of aspirating and dispensing of the sample and of reagents 1 and 2 into the reaction vial (tube).	Mixing
57	WAIT 1.0		
58	DISP 1 400.0 5		
59	WAIT 1.0		
60	LOOP	This process mixes the sample.	
61	TIMER 120.0	Sets the timer to 2 min.	
62	HEIGHT 0.0 2	Aspirates 5 µl of air into the end of the needle.	Waits for the end of the reaction time (2 minutes)
63	ASP 1 5.0 5		
64	WAIT 1.0		
65	WASH	Washes the needle, syringe and injection port.	
66	WAITTIMER		
67	SVALVE 1.0		
68	SYRINGE 1 45.0 5		

[Line No.]	[Command]	
69	HEIGHT 0.0 2	Aspirates 5 µl of air into the end of the needle.
70	ASP 1 5.0 5	
71	WAIT 1.0	
72	TUBE 3 I1	Moves the needle to reactionvial (tube) No. I1.
73	ASP 1 90.0 5	Aspirates 90.0 µl of the reacted sample.
74	WAIT 1.0	
75	HEIGHT 0.0 2	Aspirates 5 µl of air into the end of the needle.
76	ASP 1 5.0 5	
77	WAIT 1.0	
78	TUBE 0 0	
79	TUBE 0 1	Moves the needle to the injection port.
80	DISP 1 80.0 5	
81	WAIT 1.0	
82	VALVE 1	Switches the injection valve to LOAD.
83	WAIT 1.0	
84	DISP 1 30.0 5	Dispenses 30 µl of the reacted sample into the sample loop.
85	WAIT 1.0	
86	VALVE 0	Switches the injection valve to INJECT.
87	OUT 1 1	Sends the analysis start signal pulse to the analyzer.
88	WAIT 1.0	
89	OUT 1.0	
90	DISP 1 500.0 5	
91	TIMER 600.0	Sets the timer to 10 minutes.
92	WASH	Washes the needle, syringe and injection port.
93	WAITTIMER	Waits for the analysis to end (10 minutes).
94	LOOP	Returns to line No. 4 until all 32 samples have been measured.
95	HOME	Finally returns the needle and other mechanism to the home position to end the analysis.

Injection

Injection

1.8 Commands

This section explains the commands used in the programming mode. The explanation follows this order:

- ASP 1-52
- DISP 1-54
- TUBE 1-56
- HEIGHT 1-60
- VALVE 1-62
- WAIT 1-64
- WAITTIMER 1-66
- WAITSIGNAL 1-68
- TIMER 1-70
- OUT 1-72
- MOVE 1-74
- SYRINGE 1-76
- SVALVE 1-78
- SNGLINJ 1-79
- SEQINJ 1-81
- DO 1-83
- LOOP 1-86
- HOME 1-88
- WASH 1-89
- PWASH 1-90
- OPVALVE 1-92

The following symbols are used during the explanation of the commands.

*	:	Directory executable command
< >	:	Parameter necessary for command execution.
Direct execution mode	:	Where the programming mode initial display is developed. ([P] appears on the upper right of the LCD.)
TEACH mode	:	Program creation mode selected by pressing **TEACH**. ([T] appears on the upper right of the LCD.)
EDIT mode	:	Program edit mode selected by pressing **EDIT**. ([E] appears on the upper right of the LCD.)

ASP (aspirate) *

Function:

Aspirates via needle as much liquid as specified.

Format:

ASP <dilutor number> <aspiration volume> <aspiration speed>

<Dilutor number> : 1 (fixed)

<Aspiration volume> : 0 - 5000.0 µl

<Aspiration speed> : 1, 2, 3, 4, 5

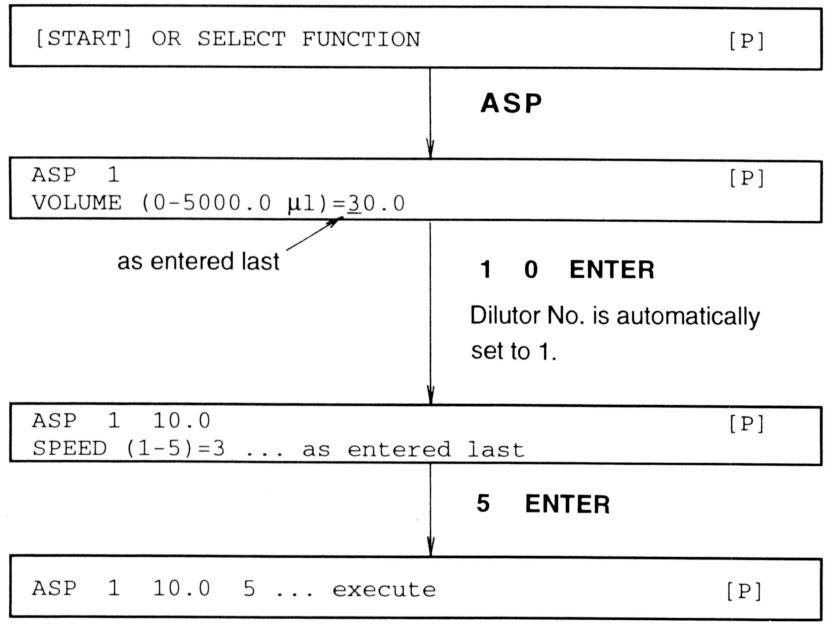
Low ← → High

Example of use :

ASP 1 10.0 5 : Aspirate, using the standard size syringe (dilutor), 10 µl at a syringe speed of 5.

Example of operation:

Key in ASP 1 10.0 5 (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

This command is used for aspirating a liquid via the needle.

Press **ASP** first when entering this command.

Key in the aspiration volume within the range of 0 to 5000.0 µl and select an aspiration speed of 1, 2, 3, 4, or 5. Aspiration speed = 1 is the lowest, and 5 the highest.

Notes:

1. If you enter an aspiration volume that exceeds a volume that can be taken in by moving the syringe plunger from its current position to the low limit position, an ERROR-PARAMETER! message will display at execution.
   Enter an aspiration volume that corresponds to the syringe capacity set through the UTILITY function.
2. The plunger high limit is reset by the SYRINGE command. (Example: SYRINGE 1 0.0 5)
3. The capacity of a syringe you are using must coincide with the syringe capacity you set using the UTILITY function. Otherwise, the specified volume is not correct.
   The actual aspiration volume is equal to the <aspiration volume> × ((mounted syringe capacity)/(syringe capacity setting)).
   Example: When the installed syringe capacity you are using is 100 µl and the syringe capacity set is 3 (1000 µl), executing the command ASP 1 100.0 5, aspirates only 10 µl.
4. Set the aspiration speed within the range of 1 to 3 for a 2.5 ml syringe and within the range of 1 to 2 for a 5 ml syringe. An error (ERROR-PARAMETER!) message occurs if you execute an aspiration speed that is out of the range for the syringe you are using.

DISP (dispense) *

Function:

Dispenses via the needle as much liquid as specified.

Format:

DISP <dilutor number> <dispensing volume> <dispensing speed>

<Dilutor number> : 1 (fixed)

<Dispensing volume> : 0 - 5000.0 µl

<Dispensing speed> : 1, 2, 3, 4, 5

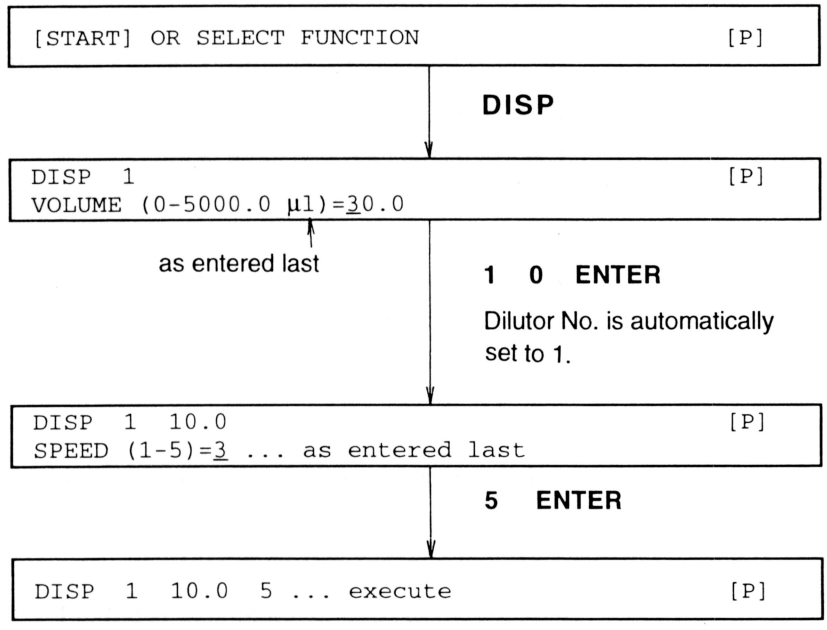
Low ← → High

Example of use:

DISP 1 10.0 5 : Dispense, using the standard size syringe (dilutor), 10 µl at a syringe speed of 5.

Example of operation:

Key in DISP 1 10.0 5 (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

Use DISP (dispense) for delivering a liquid via the needle. When entering this command, press **DISP**.

Key in the dispensing volume within the range of 0 to 5000.0 µl and select a dispensing speed of 1, 2, 3, 4 or 5.

Dispensing speed = 1 is the lowest, and 5 is the highest.

Notes:

1. The capacity of the syringe you are using must coincide with the syringe capacity set with the UTILITY function. Otherwise, the specified volume will not be correct.
   The actual dispensed volume is equal to the <dispensing volume> × ((mounted syringe capacity)/(syringe capacity setting)).
   Example: If the syringe you are using has a capacity of 100 µl and the syringe capacity set is 3 (1000 µl), executing DISP 1 100.0 5 delivers only 10 µl.
2. Set the dispensing speed within the range of 1 to 3 when using a 2.5 ml syringe and within the range of 1 to 2 when using a 5 ml syringe. An error (ERROR-PARAMETER!) message occurs when executing an operation under a dispensing speed that is out of range.
3. When you specify a dispensing amount that is larger than the capacity of the syringe, the plunger must move up and down several times to dispense the specified volume.

TUBE (tube) *

Functions:

1. Moves the needle to a designated tube (vial).
2. Moves the needle to the washing port or the injection port.

Formats:

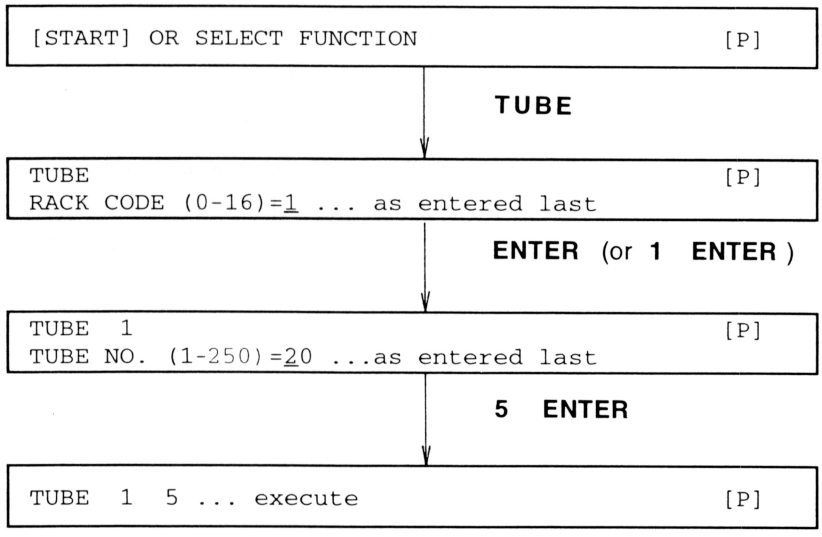
1. TUBE <rack code> <tube number>
   <Rack code> : 1-16
   <tube number> : 1-250
2. TUBE 0 <port number. : 0, 1 { 0: washing port / 1: injection port }

Example of use:

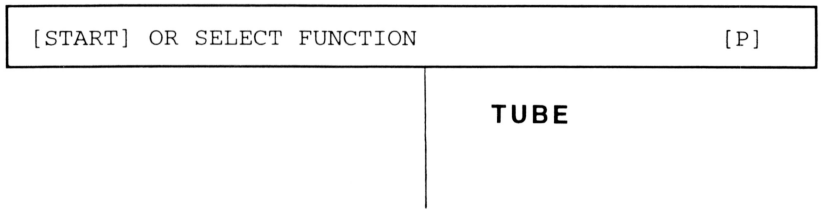
1. TUBE 1 5 : Moves the needle to tube (vial) number = 5 according to the rack parameter of rack code = 1.
2. TUBE 0 0 : Moves the needle to the washing port.
3. TUBE 0 1 : Moves the needle to the injection port.

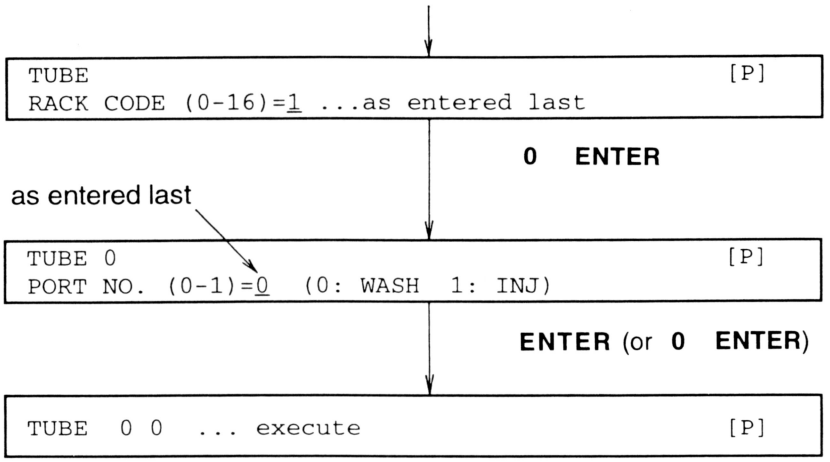
Example of operation:

1. Key in TUBE 1 5 (in the direct execution mode)



2. Key in TUBE 0 0 (in the direct execution mode)





The operation is the same in the TEACH mode or the EDIT mode.

Comment:

TUBE moves the needle to the washing port or the injection port or to a specified tube number according to a rack parameter set by a rack code.

Press **TUBE** to enter this command. A prompt "RACK CODE (0-16)=1" appears. The prompt shows the last value entered and allows you to change it.

Notes:

1. To move the needle to a vial (tube) on the rack, select the rack code that corresponds to the rack that is currently in place. Subsequently, a prompt "TUBE NO. (1-250)=20" appears. Enter the vial (tube) position.
   When you execute the command, the position of the selected vial (tube) number is calculated according to the rack code you entered. The needle then moves into the position for that vial. The needle height is also determined by the rack code.
2. When you want to move the needle to the washing or the injection port, key in a rack code = 0. A prompt for the input of the port number appears as "PORT NO. (0-1)=0 (0: WASH, 1: INJ)". Key in 0 to move to the washing port or 1 to move to the injection port. When you execute the command, the needle moves to the designated port and the needle is placed inside the port.

Contents of rack parameters:

(1) x1: Position on x scale of first tube

(2) y1: Position on y scale of first tube

(3) x2: Position on x scale of last tube

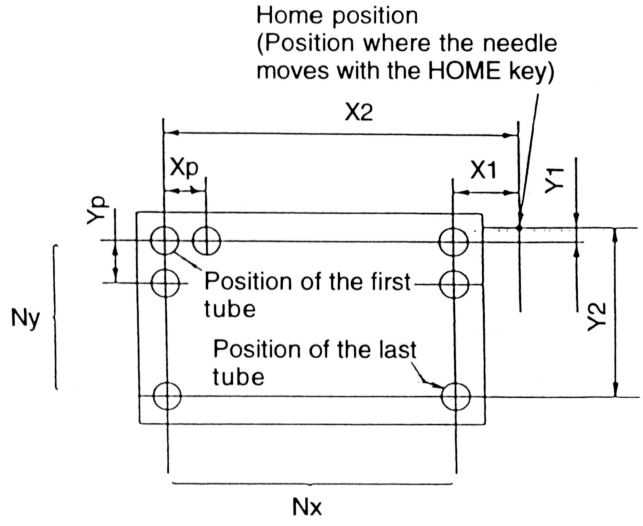
(4) y2: Position on y scale of last tube

(5) z : Needle height (distance from top point)

(6) Nx:Number of tubes on x scale

(7) Ny: Number of tubes on y scale

(8) P : Operation pattern



Notes:

1. Before executing the TUBE command, use the UTILITY function to set the rack parameter for the rack you are using.
2. Before executing this command, make sure the rack parameter coincides with the rack you are using. Otherwise, the needle moves to the wrong position, even when the tube number is within the range of 1 to 250. An ERROR-PARAMETER! message occurs if the tube position exceeds any of the following limits:
   - Position of x scale exceeds 156.0 mm
   - Position of y scale exceeds 156.0 mm

3. A tube detection function takes place when the needle moves to the tube position and it is at the height designated by the rack parameter.
   The message "NO TUBE!" appears if there is no tube present, and the operation stops.
4. The speed for lowering the needle depends on the "NEEDLE DOWN SPEED" set through the UTILITY function.

HEIGHT (height) *

Function:

Moves the needle to a designated height

Format:

HEIGHT <height> <moving speed>

<Height> : 0-57.0 mm (distance from uppermost point)

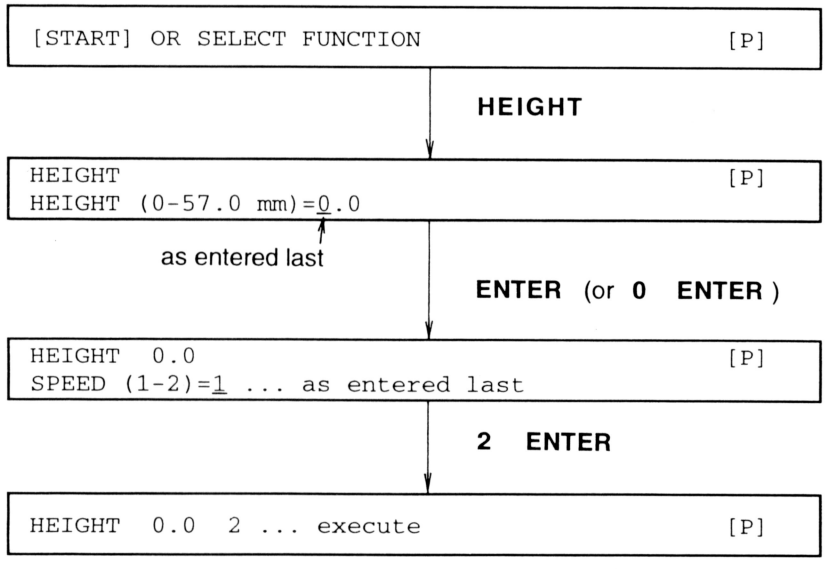
<Moving speed> : 1, 2 { 1: low speed / 2: high speed }

Example of use:

1. HEIGHT 0.0 2 : moves the needle at high speed to the uppermost point
2. HEIGHT 55.0 1 : moves the needle at low speed to a height of 55.0 mm below the uppermost point

Example of operation:

Key in HEIGHT 0.0 2 (in the direct execution mode)



The operation is the same in the TEACH mode or the EDIT mode. In the direct execution mode or the TEACH mode, you can set the height by moving the needle with the △ or ▽ keys.

(For details, see Section 1.4.1.)

Comment:

Use HEIGHT to move the needle to a specified height.

Press **HEIGHT** to enter this command. A prompt "HEIGHT (0-57.0mm)=0.0" shows the last value you entered and allows you to change it. Press **ENTER** if you do not want to change the last value.

Then a prompt, "SPEED (1-2)=1", appears to let you define the needle moving speed. Key in 1 to move at a low speed or 2 to move at a high speed.

Notes: When you execute this command, the unit does not perform the vial detection function.

VALVE (valve) *

Function:

Switches the injection valve position

Format:

VALVE <valve position>

<Valve position> : 0, 1 0: INJECT side

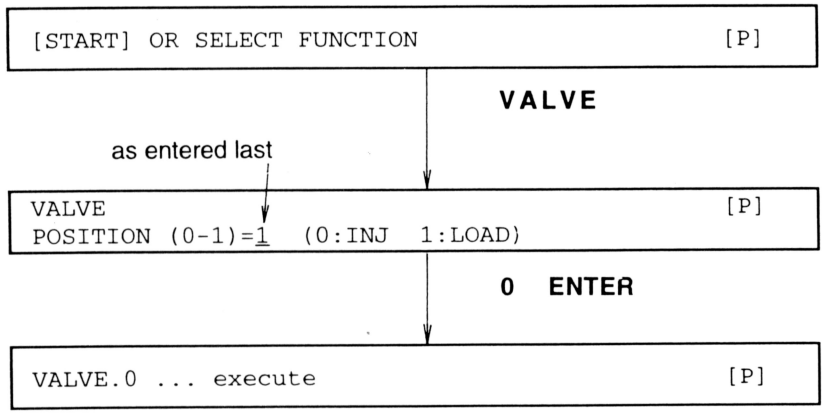
1: LOAD side

Example of use:

VALVE 0 : Switches the injection valve to the INJECT side.

Example of operation:

Key in VALVE 0 (in the direct execution mode)



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

Switches the injection valve to the INJECT or the LOAD side.

Press **VALVE** to enter this command.

A prompt, "POSITION (0-1)=1", allows you to select the injection valve position. The prompt also shows the injection valve position entered last. Key in 0 to change over to INJECT or 1 to change over to LOAD.

Note:

Allow at least a 20 second interval between consecutive LOAD commands when switching the injection valve from LOAD to INJECT and back to LOAD. This 20 second time lapse is very important and helps protect the injector.

LOAD
INJECT } Lapse of about 20 seconds
LOAD.

WAIT (wait)

Function:

Waits for as many seconds as you specify. You can specify 1/10 second steps. Use WAIT in the program mode only.

Format:

WAIT <Wait time>

<Wait time> : 0-99999.9 s

Example of use:

[Line No.] [Command]

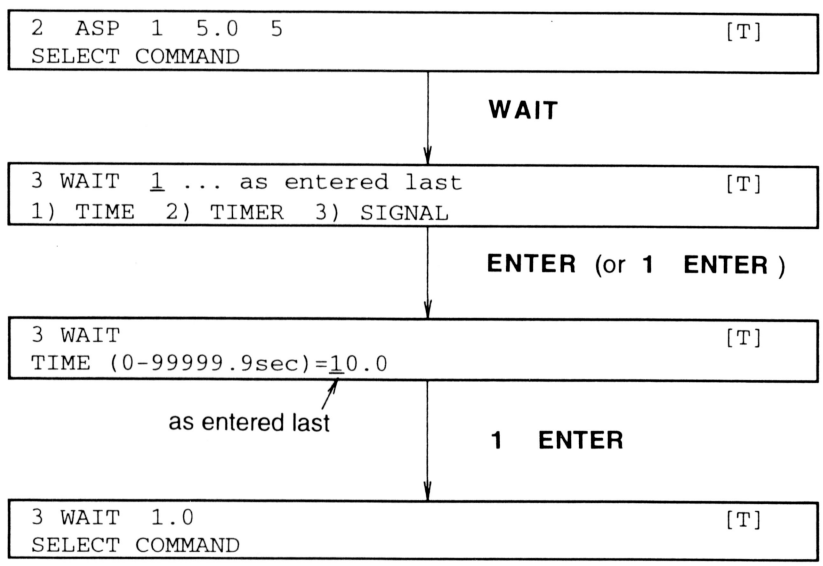
1 HEIGHT 0.0 2 : Moves the needle to the uppermost point

2 ASP 1 5.0 5 : Aspirates 5 µl of air

3 WAIT 1.0 : Waits for 1 second

Example of operation:

Key in WAIT 1.0 (in the TEACH mode).



The operation is the same in the EDIT mode.

Comment:

Use this commanmd to wait during processing.

Press **WAIT** to enter this command.

Then the following items appear: "1) TIME, 2) TIMER, 3) SIGNAL". To specify the WAIT command, select (1) TIME. A prompt,"TIME (0-99999.9sec)=10.0", appears. You can now enter a new time in seconds.

Notes:

1. If you press **WAIT** while in the direct execution mode (programming mode initial display), the command is ignored.
2. In the TEACH mode, you can cancel the WAIT command execution (wait time) by pressing **ENTER**.

WAITTIMER (wait timer)

Function:

Waits until the time specified by the TIMER command elapses. This command is effective when you use it in a program with the TIMER command.

Format:

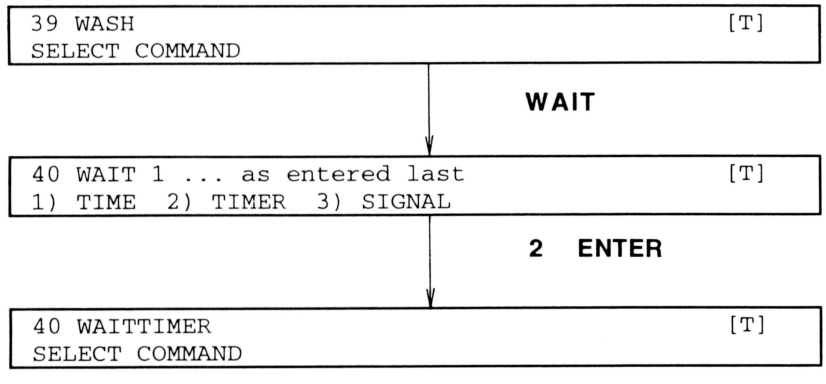
WAITTIMER

Example of use:

[Line No.]	[Command]	
35	TIMER 60.0	: Sets the timer to 60 seconds
36	HEIGHT 0.0 2	: Moves the needle to its uppermost point
37	ASP 1 5.0 5	: Aspirates 5 µl of air
38	WAIT 1.0	: Waits for 1.0 second
39	WASH	Washes the needle, syringe, injection port
40	WAITTIMER	Waits until the 60 seconds set by TIMER elapse.

Example of operation:

Input WAITTIMER (in the TEACH mode).



The operation is the same in the EDIT mode.

Comment:

Use WAITTIMER to set a timer. The unit checks the lapse of time set in the TIMER command. If it has passed, the controller transfers execution to the next command or, if it has not, the controller waits until the time passes.

Press **WAIT** to enter this command. Then the following prompt appears: "1) TIME, 2) TIMER, 3) SIGNAL". Select 2) TIMER and specify the WAITTIMER command.

WAITTIMER command is significant when you use it with the TIMER command (the order of execution must be TIMER and WAITTIMER).

(If you use WAITTIMER by itself, it has no effect and does not cause any errors during its execution.)

Notes:

1. If you press **WAIT** while in the direct execution mode (programming mode initial display), the command is ignored.
2. In the TEACH mode, the WAITTIMER command execution (wait time) cancels when you press **ENTER**.
3. If 2 or more WAITTIMER commands are entered after a TIMER command, the WAITTIMER command that is nearest to the TIMER command has preference. All other (Invalid) WAITTIMER commands are ignored.

   Example : TIMER 60.0
   ⋮
   WAITTIMER.....Valid (wait until 60 seconds elapse since TIMER 60.0)
   WAITTIMER.....Invalid

WAITSIGNAL (wait signal)

Function:

Waits until the bit of an input port is at a designated level. You can only use the WAITSIGNAL command in the program mode.

Format:

WAITSIGNAL <bit number> <level>

<Bit number> : 3, 4, 5, 6, 7, 8

<Level> : 0, 1 { 0: (CLOSE, LOW)
1: (OPEN, HIGH)

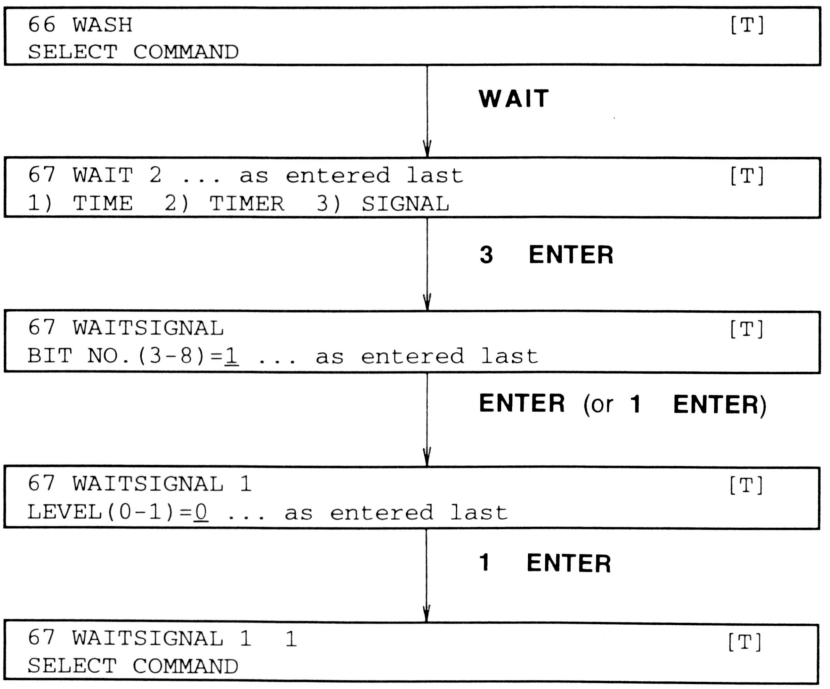
Note: Bit No. 1, 2 are fixed as "START IN", "STOP IN" signals (see Section 2.1.1).

Example of use:

[Line No.]	[Command]	
60	TUBE 0 1	: Inserts the needle into the injection point.
61	DISP 1 100.0 5	: Dispenses 100 µl
62	WAIT 3.0	: Waits 3 seconds
63	OUT 1 1	: Sets the output port bit 1 to 1 (HIGH). (Example: Analysis start signal ON.)
64	WAIT 1.0	: Waits 1 second
65	OUT 1 0	: Sets the output port bit 1 to 0 (LOW). (Example: Analysis start signal OFF.)
66	WASH	: Washes the needle, syringe, injection port
67	WAITSIGNAL 3 1	: Waits until input port bit 3 is 1 (HIGH). (Waits for the analysis to end)

Example of operation:

Key in WAITSIGNAL 1 1 (in the TEACH mode).



The operation is the same in the EDIT mode.

Comment:

Waits for the status of an analyzer to change (such as when the analysis ends.) The analyzer is connected to the autosampler via its input port.

When entering this command, press **WAIT**. Then the following choices appear: "1) TIME, 2) TIMER, 3) SIGNAL". Select 3) SIGNAL to designate the WAITSIGNAL command. A prompt for designating the bit number of an input port and the value you entered last appears as "BIT NO.(3-8)=3". Key in the bit number of the input port you want to use. A prompt, "LEVEL(0-1)=0", allows to designate the signal level.

Key in the signal level. 0: LOW (CLOSE) and 1: HIGH (OPEN).

Notes:

1. If you press **WAIT** while in the direct execution mode (programming mode initial display), the command is ignored.
2. In the TEACH mode, pressing **ENTER** cancels the WAITSIGNAL command execution (signal input wait).

TIMER (timer)

Function:

Sets a timer. This command is effective when used in a program with the WAITTIMER command.

Format:

TIMER <time>

<Time> : 0-99999.9 s

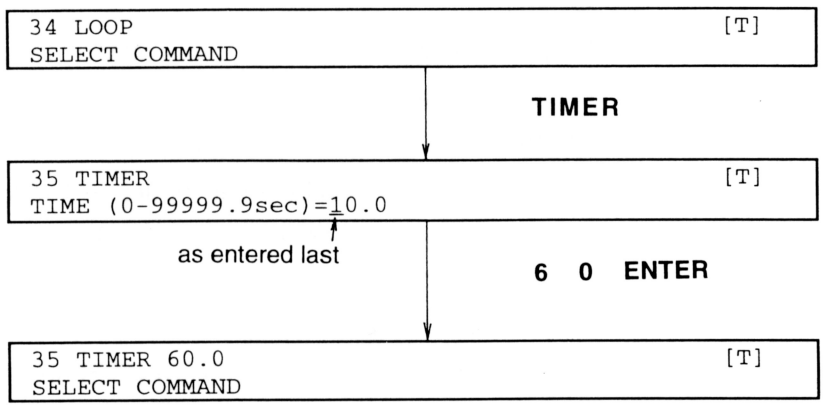
Example of use:

[Line No.] [Command]

35	TIMER 60.0	: Sets the timer to 60 seconds
36	HEIGHT 0.0 2	: Moves the needle to the uppermost point
37	ASP 1 5.0 5	: Aspirates 5 µl of air
38	WAIT 1.0	: Waits for 1 second
39	WASH	: Washes the needle, syringe, injection port
40	WAITTIMER	: Waits for 60 seconds after the execution of the TIMER command.

Example of operation:

Key in TIMER 60.0 (in the TEACH mode).



The operation is the same in the EDIT mode.

Command:

Use TIMER to set a time. When you use the WAIT command, you can not execute another process until the wait time elapses. When using the TIMER and the WAITTIMER commands, you can designate a process between the TIMER and the WAITTIMER commands as long as that process ends in a time shorter than the one set by the TIMER command.

Press **TIMER** to enter this command. A prompt "TIME (0-99999.9sec)=10.0" shows the value you entered last and lets you change it. Key in a timer setting in seconds to change it.

The TIMER command has no effect unless it is used with the WAITTIMER command. The order of execution has to be TIMER-WAITTIMER. If you use TIMER alone, it has no effect and does not cause any errors during program execution.

Notes:

1. If you press **TIMER** while in the direct execution mode (programming mode initial display), the command is ignored.
2: If you specify 2 or more TIMER commands before a WAITTIMER command, only the TIMER command nearest to the WAITTIMER command is valid. The other TIMER commands are ignored (invalid).

Example:
```
TIMER     300.0 : Invalid
  |
  |
TIMER      50.0 : Valid
  |
  |
WAITTIMER       : Waits for 50 seconds since
                  execution of the TIMER step.
```

OUT (out) *

Function:

Sets to a designated level the chosen bit of an output port.

Format:

OUT <bit number> <level>

<Bit number> 1, 2, 3, 4, 5, 6, 7, 8

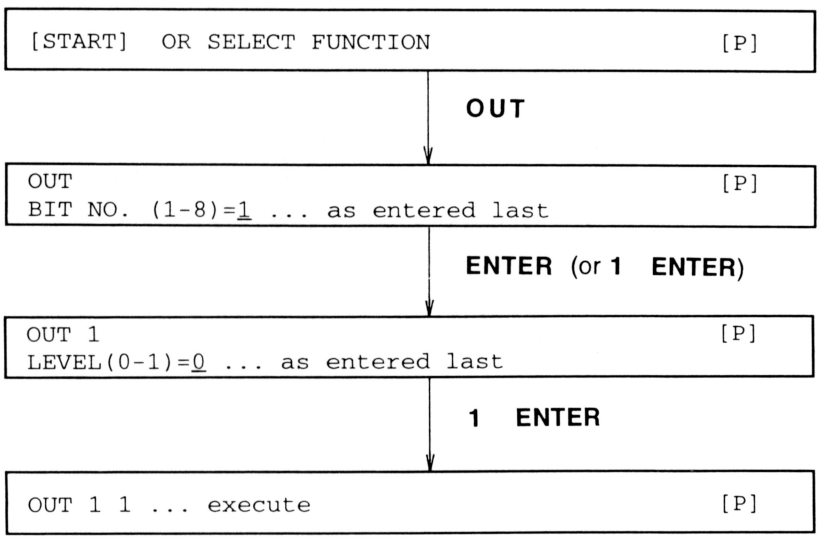
<Level> : 0, 1 { 0: LOW (OPEN)
1: HIGH (CLOSE)

Example of use:

OUT 1 1 : Sets the output port bit 1 to 1 (HIGH).

Example of operation:

Key in OUT 1 1 (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

Use the OUT command to start an analysis. For example, to start an analyzer that is connected to the autosampler via the output port. Press the **OUT** key. A prompt, "BIT NO.(1-8)=1", lets you select the output port bit number and shows the value you entered last. Key in the bit number of the output port you are using. Another prompt for designating a signal level appears as "LEVEL(0-1)=0".

Key in a signal level, 0:LOW (OPEN) or 1:HIGH (CLOSE). Make it a rule to send an analysis start signal (OUT 1 1) and, after waiting for a certain time, cancel the start signal (OUT 1 0). Unless you cancel the start signal, the start signal will be active at all times.

Example:

```
TUBE 0   1        : Inserts the needle into the injection port.
DISP 1 100.0 5    : Dispenses 100 µl.
WAIT 3.0          : Waits 3 seconds.
OUT  1   1        : Turns on a start signal.
WAIT 1.0          : Waits 1 second.
OUT  1 0          : Turns off a start signal.
```

MOVE (move) *

Function:

Moves the needle to an absolute position (on the X, Y, and Z scales) from its origin. Press the **HOME** key to set the origin.

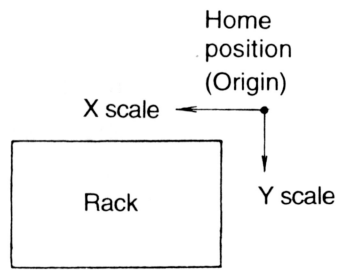
Format:

Move <X position> <Y position> <Z position>

<X position>: 0-156.0 mm (sidewise)

<Y position>: 0-156.0 mm (crosswise)

<Z position>: 0-57.0 mm (vertical)



Example of use:

MOVE 32.0 73.0 57.0 : Moves the needle 32 mm on the X scale, 73 mm on the Y scale, and sets its height to 57 mm.

Example of operation:

Key in MOVE 32.0 73.0 57.0 (in the direct execution mode).

```
[START] OR SELECT FUNCTION                          [P]
```

FUNC1

```
FUNC1  1                                            [P]
1) MOVE   2) PWASH   3) OPVALVE
```

ENTER (or **1 ENTER**)

```
MOVE                                                [P]
X (0-156.0 mm)=10.0 ... as entered last
```

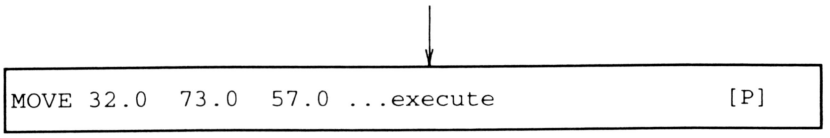
3 2 ENTER

```
MOVE 32.0                                           [P]
Y (0-156.0 mm)=10.0 ...
```

7 3 ENTER

```
MOVE 32.0  73.0                                     [P]
Z (0-57.0 mm) =0.0 ...as entered last
```

5 7 ENTER



The operation is the same in the TEACH mode or the EDIT mode. In the direct mode or the TEACH mode, you can set the X, Y and Z positions by moving the needle with the △ or ▽ keys. (For details, see Section 1.4.1 2.)

Comment:

Use MOVE to place the needle at an arbitrary vial position. Press **FUNC1** to enter this command. The command selecting items appear as "1)MOVE, 2)PWASH, 3)OPVALVE. Select 1)MOVE to choose the MOVE command. Another prompt, "X(0-156.0mm)=10.0", appears. This prompt will let you enter the X position. Key in the X position in mm (distance of the X scale from the origin) to where you will move the needle. Still another prompt appears for the input of the Y position as "Y(0-156.0mm)=10.0". Key in the Y position in mm (distance on the Y scale from the origin) to where you will move the needle. Another prompt appears for input of the Z position as "Z(0-156.0mm)=0.0". Key in the height in mm (distance from the uppermost point). This is the position where the needle will move. The needle descends at the "NEEDLE DOWN SPEED" that is set by the UTILITY function and always ascends at a high speed.

⚠ CAUTION

The autosampler does not perform a tube detection function when executing the MOVE command. Exercise care not to damage the needle.

SYRINGE (syringe) *

Function:

Moves the syringe plunger to a selected position.

Format:

SYRINGE <dilutor number> <position> <moving speed>

<Dilutor number> : 1 (fixed)

<Position> : 0-5000.0 µl

<Moving speed> : 1, 2, 3, 4, 5

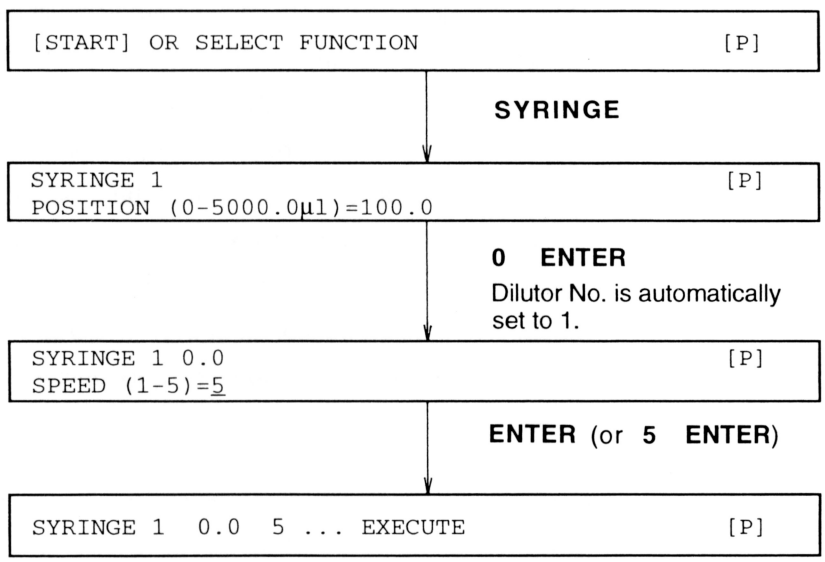
Low← →High

Example of use:

SYRINGE 1 0.0 5 : Sets the standard size syringe plunger to the high limit.

Example of operation:

Key in SYRINGE 1 0.0 5 (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

This command positions the plunger of a designated syringe at a specific volume setting, for example, at 0 µl. When you use SYRINGE with the SVALVE command, it allows you to aspirate a liquid from the bottle.

Press **SYRINGE** to enter this command. A prompt, "0-5000.0μl)=100.0", appears that allows you enter a new plunger position or retain the one entered last. Key in a plunger position that lets you aspirate a volume by moving the plunger downward with respect to the high limit position of the plunger.

Example : When using a 100 μl syringe, the high limit position is 0 μl, the middle position is 50 μl and the low limit position is 100 μl.)

After defining the volume, another prompt appears, "SPEED(1-5)-5". That prompt lets you enter a new plunger moving speed or retain the one you entered last. One is the lowest plunger speed and five is the highest.

Notes:

1. The capacity of syringe being used must agree with the syringe capacity set by the UTILITY function. Otherwise, the plunger position will be incorrect.
   The actual plunger position is equal to the command-designated plunger position × {(installed syringe capacity)/(set value)}
   Example: When the syringe capacity is 100 μl and the syringe capacity setting is 3 (1000 μl), entering a SYRINGE 1 100.0 (volume) 5 (speed) command will position the plunger to take up 10 μl when the plunger moves to the high limit.
2. When the <position> resulting from the SYRINGE command is greater than the setting allowed by the UTILITY function, an error occurs.
   Example: When you execute the SYRINGE 1 500.0 5 command with syringe capacity set to a value of 100 μl, the ERROR-PARAMETER! message occurs.
3. Select the moving speed within the range of 1 to 3 for a 2.5 ml syringe and within the range of 1 to 2 for a 5 ml syringe. When you enter an incorrect syringe speed, an ERROR-PARAMETER! message appears during the command execution.

SVALVE (syringe valve) *

Function:

Switches the syringe valve to the needle or the bottle side.

Format:

SVALVE <dilutor number> <position>

<Dilutor number> : 1 (fixed)

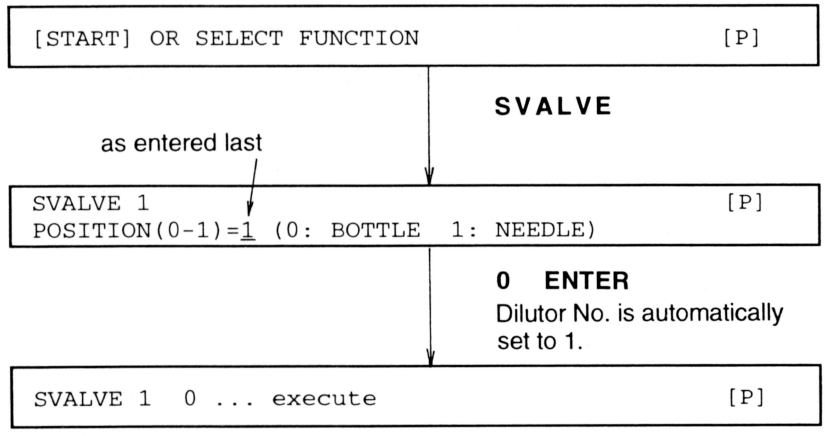
<Position> : 0, 1 { 0: bottle side / 1: needle side

Example of use:

SVALVE 1 0: Switches the syringe valve to the bottle side.

Example of operation:

Key in SVALVE 1 0 (in the direct execution mode).



The operation is the same in the TEACH or EDIT mode.

Comment:

Switches the syringe valve to the needle or bottle side.

Use SYRINGE with **SVALVE** to aspirate liquid from the bottle side.

Press **SVALVE** to enter this command.

A prompt, "POSITION(0-1)=1 (0: BOTTLE, 1: NEEDLE)", appears that lets you designate the syringe valve position. Key in 0 for the bottle side or 1 for the needle side.

SNGLINJ (single injection)*

Function:

According to the injection condition defined in the sequential mode, this command performs single injection of a specified volume of sample from a specified sample vial.
This command is effective only in the programming mode.

Format:

SNGLINJ <rack code> <test tube (vial) No.> <injection volume>
<Rack code> : 1 to 16
<Test tube (vial) No.> : 1 to 250
<Injection volume> : 0 to 4000.0 µl

Example of use:

```
[Line No.]          [Command]
    :                   :
    :                   :
    4           DO  50  1  1.0  1.0
    :                   :
   86           SNGLINJ  1  1  20.0
   87           LOOP
```

Pre-processing is carried out for 50 samples, and then single injection is performed.

Example of operation:

Input (in the TEACH mode)

```
85 DISP 1 100.0  5                                        [T]
SELECT COMMAND
```

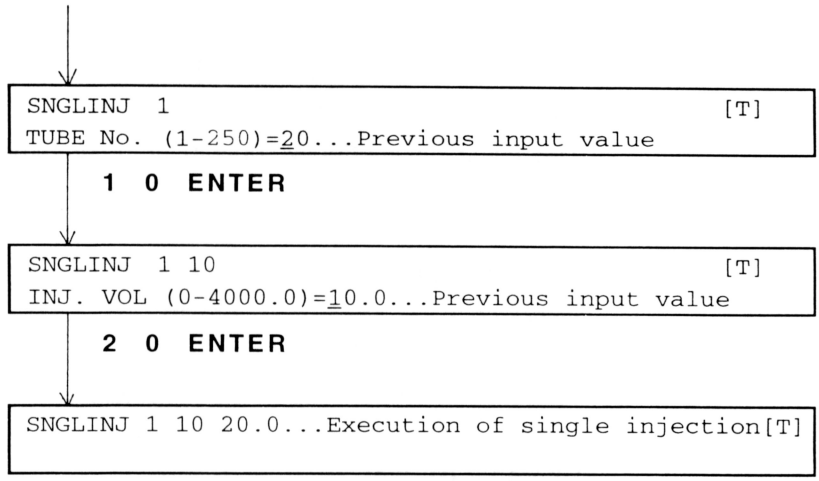
FUNC2

```
86 FUNC2  1 ... Previous input value                      [T]
1) SNGLINJ   2) SEQINJ
```

1 ENTER

```
SNGLINJ                                                   [T]
RACK CODE (0-16)=1...Previous input value
```

1 ENTER



The sequence is the same in the EDIT mode also.

Comment:

After pre-processing, you can perform single injection without having to define details of injection condition. The SEQINJ command is useful for batch pre-processing, and the SNGLINJ command is useful for serial processing.

For execution of this command, press **FUNC2** key first. When the command menu "1) SNGLINJ 2) SEQINJ" appears, choose 1)SNGLINJ for single injection. Then, enter desired parameters.

Remarks:

1. This command is not specifiable in the direct execution mode. It can be specified and run in the programming mode only.
2. Although this command may be specified in the TEACH mode, its execution cannot be performed.

SEQINJ (sequential injection)

Function:

Executes a program set by the **SET PROG** key while in the sequential mode.

The operation caused by the SEQINJ command is the same as when you press **START** in the sequential mode. SEQINJ command is only effective in the program mode.

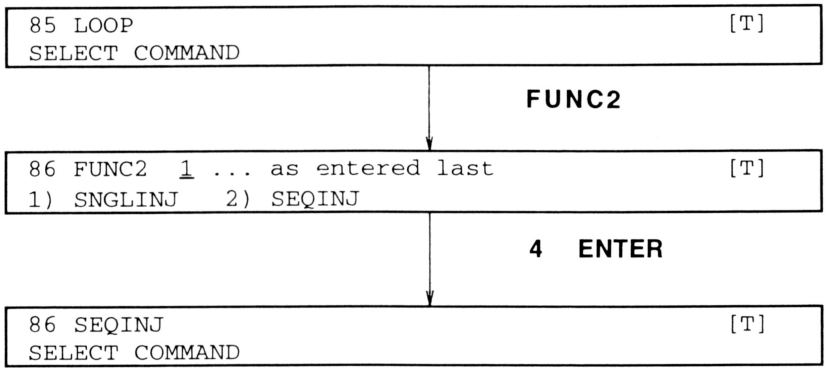
Format: SEQINJ

Example of use:

```
[Line No.]      [Command]
    :               :
    4           DO  50 1 1.0 1.0   ┐
    :               :              │ sample preparation of
    :               :              │ 50 samples
    85          LOOP               ┘
    86          SEQINJ  : sequential injection
```

Example of operation:

Key in SEQINJ (in the TEACH mode).



The operation is the same in the EDIT mode.

Comment:

Use this command at the top of a program to create a sequential injection process that follows sample pretreatment.

First press **FUNC2** to select the SEQINJ command. The prompt appears as 1)SNGLINJ, 2)SEQINJ. Select 2)SEQINJ.

Notes:

1. You can not use the SEQINJ command in the direct execution mode. Use the SEQINJ command in the program mode only.
2. You can specify SEQINJ in the TEACH mode, but you can not execute it.
3. You can execute the SEQINJ command to start a program that was set in the sequential mode by the **SET PROG** key. The display indicates that a sequential injection is in progress.

DO (do)

Function:

Repeats the process that is between the DO and the LOOP commands. You can use DO in the program mode only.

Format:

DO <number of repetitions> <variable number>
<initial value of variable> <step value>

<Number of repetitions> : 1-250
<Variable number> : 1-20
<Initial value of variable> : 0-9999.9
<Step value> : 0-9999.9

Example of use:

```
[Line No.]  [Command]
    :           :
    3       WASH                : Washes the needle, injection
                                  port, syringe

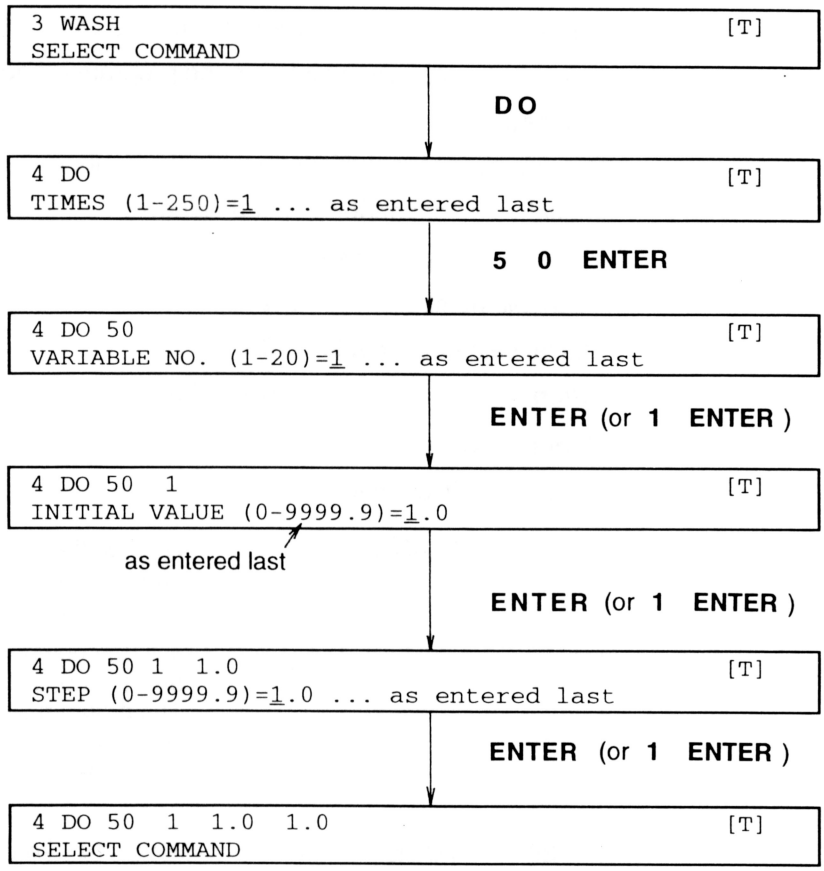
┌── 4       DO 50  1  1.0  1.0  : Sets the number of repetitions to
                                  50, I1←1.0, step value to 1.0
    :           :                 The program steps (between the
    :           :                 DO and the LOOP command in
    :           :                 line 85) will repeat 50 times.
    :           :
    28      TUBE   1  I1        : Moves the needle to the first tube
                                  on the rack with a code of 1. I1
                                  increments by 1 at the repetition of
                                  each step.

┌──┌29      DO  3  2  1.0  1.0  : Sets the number of repetitions to
                                  3, I2←1.0, step value is 1.0.
                                  (I1 is used for the outside DO loop
                                  (line No.= 4), I2 is set. The
                                  process up to the LOOP
                                  command in line No.= 34 repeats 3
                                  times.)

   30       ASP  1  100.0  5   ┐
   31       WAIT   1.0         │
   32       DISP 1  100.0  5   } Repeats the mixing process
   33       WAIT   1.0         │ 3 times.
  └34       LOOP               ┘
    :           :
    :           :
  └── 85      LOOP
```

Example of operation:

Key in DO 50 1 1.0 1.0 (in the TEACH mode).



The operation is the same in the EDIT mode.

Comment:

This command repeats a process as often as you designate. DO designates the number of repetitions. The process repeats the steps up to the LOOP command.

(Refer to lines No. = 29 to 34 for an example of their use.)

You can follow the number of repetitions with a variable number, the initial value of the variable, and the step value.

You can also designate a variable as a command parameter. If you use for the variable the same number as you designate in the DO - LOOP , the initial value of the DO command is set by that variable at the 1st execution. If in line No.= 28 you use TUBE 1 I1=TUBE 1 1., every time the operation repeats, the step value is added to the variable. For example, the 2nd time, TUBE 1 I1=TUBE 1 2. The 3rd time: TUBE 1 I1=TUBE 1 3. ... and the 50th time: TUBE 1 I1=TUBE 1 50. Thus the needle moves to each tube one by one in order to complete the process.

Press **DO** to enter the command. A prompt appears, "TIMES (1-250)=1". Key in the number of repetitions within the range of 1-250. Wait for another prompt to appear "VARIABLE NO. (1-20)=1". Specify a variable number. Another prompt "INITIAL VALUE (0-9999.9)=1.0". Key in the initial value of a variable within the range of 0-9999.9.

The next prompt to appear is "STEP (0-9999.9) = 1.0". Key in the step increment within the range of 0-9999.9.

Notes:

1. You must use the DO command with the LOOP command. The DO command must precede the LOOP command. If you do not have an equal number of DO and LOOP commands or if you reverse the order of the DO and LOOP commands, the message “ERROR-SYNTAX!” displays at program execution.
2. You can designate any value for the <number of repetitions>, the <initial value of variable> and the <step value>.

LOOP (loop)

Function:

Repeats the process that is contained between the DO and LOOP commands. You can only use LOOP in the program mode.

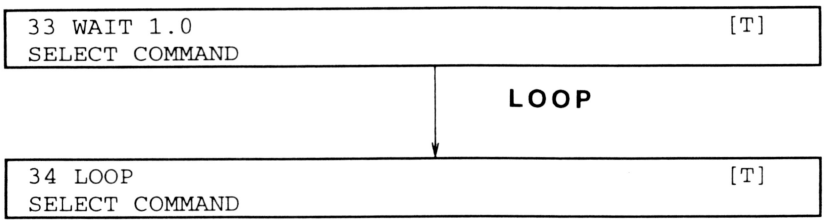
Format: LOOP

Example of use:

```
[Line No.]  [Command]
    :           :
    3       WASH              : Washes the needle, injection port,
                                  and syringe
┌── 4       DO 50  1  1.0  1.0 : Sets the number of repetitions =
:   :         :                  50, I1←1.0, step value = 1.0(The
:   :         :                  process up to the LOOP command
:   :         :                  in line No.= 85 repeats 50 times.)
:   :         :
:   :         :
:   28      TUBE 1  I1          : Moves the needle to the I1 tube on
:                                  the rack of code = 1 (at each
:                                  repetition, the step value = 1.0 will
:                                  add to I1.)
:
:  ┌29       DO 3  2  1.0  1.0  : Sets the number of repetitions to
:  :                              3, I2←1.0, and step value to 1.0.
:  :                              Because I1 is used for the outside
:  :                              DO loop (line NO. =  4), I2 is set.
:  :                              The process up to the LOOP
:  :                              command in  line No. 34 repeats 3
:  :                              times.
:  :
:  :  30      ASP 1  100.0  5  ┐
:  :  31      WAIT 1.0         │
:  :  32      DISP 1  100.0  5 ├ Repeats the mixing process 3
:  :  33      WAIT 1.0         │ times.
:  └─ 34      LOOP             ┘
:     :         :
:     :         :
└──── 85      LOOP
```

Example of operation:

Input LOOP (in the TEACH mode).



The operation is the same in the EDIT mode.

Comment:

This command repeats a series of processes as often as you designate. DO designates the number of repetitions. LOOP designates the process to be repeated.
(Lines 29 to 34 show an example of their use.)
You can follow the number of repetitions with a variable number, the initial value of the variable, and the step value. By designating as a command parameter a variable, the initial value of the DO command is set by that variable at the 1st execution.
If in line 28 you set the variable to TUBE 1 I1=TUBE 1 1. Every time the program repeats this line, the step value is added to the variable. (For example, at the 2nd time: TUBE 1 I1=TUBE 1 2, the 3rd time: 1 I1=TUBE 1 3, ... and the 50th time: TUBE 1 I1=TUBE 1 50. The needle moves to each tube (vial) one by one, until it completes the process.)
Press **LOOP** to enter the command.

Note:

You must use the DO command with the LOOP command. The DO command must precede the LOOP command. If you do not have an equal number of DO and LOOP commands or if you reverse the order of the DO and LOOP commands, the message "ERROR-SYNTAX!" displays at program execution.

HOME (home) *

Function:

Returns the needle, plunger, and other mechanisms to the home position.

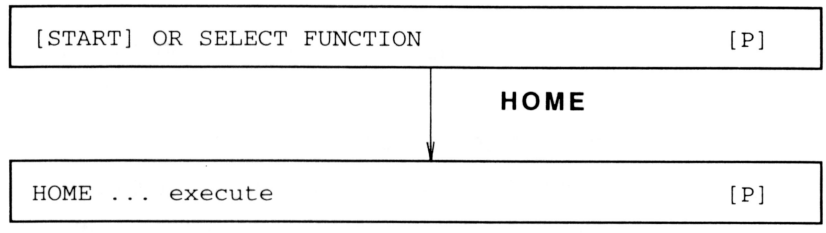
Format: HOME

Example of use:

HOME : Returns the mechanism to the home position.

Example of operation:

Input HOME (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

By placing a HOME command at the start and at the end of a program, the program (e.g. for sample preparation) starts and ends after automatically placing the needle, plunger, and other mechanism at the home position.

Press **HOME** to enter this command.

WASH (wash) *

Function:

Moves the needle to the washing port and dispenses the washing liquid. Washes the injection port and the syringe.

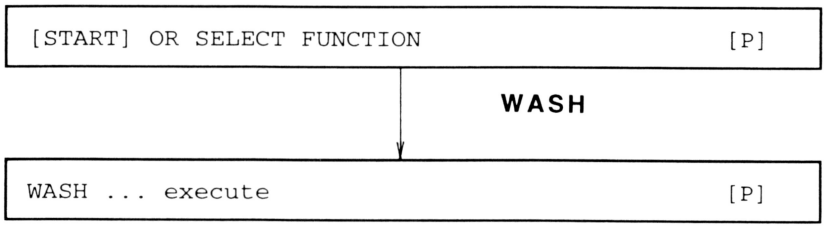
Format: WASH

Example of use:

WASH : Washes the needle, injection port, syringe.

Example of operation:

Input WASH (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

Use this command to wash the needle, injection port, and syringe. The UTILITY function determines how often the plunger moves vertically during the syringe washing operation.

Press **WASH** to enter this command.

Notes:

1. After the complete execution of the command, the syringe plunger aspirates 5 µl. This is done to prevent liquid dripping from the needle as it moves after the washing.
2. Use a syringe speed of 5 for the 0.1 ml to 1.0 ml syringes. Use a syringe speed of 3 for a 2.5 ml syringe. Use a syringe speed of 2 for a 5 ml syringe.

PWASH (pump wash)*

Function:

This command causes the autosampler wash solution to wash the pump plunger and the pump plunger seals.

Format:

PWASH <dilutor number> <aspiration volume> <syringe speed>

<Dilutor number> : 1 (fixed)

<Aspiration volume> : 0-5000.0 µl

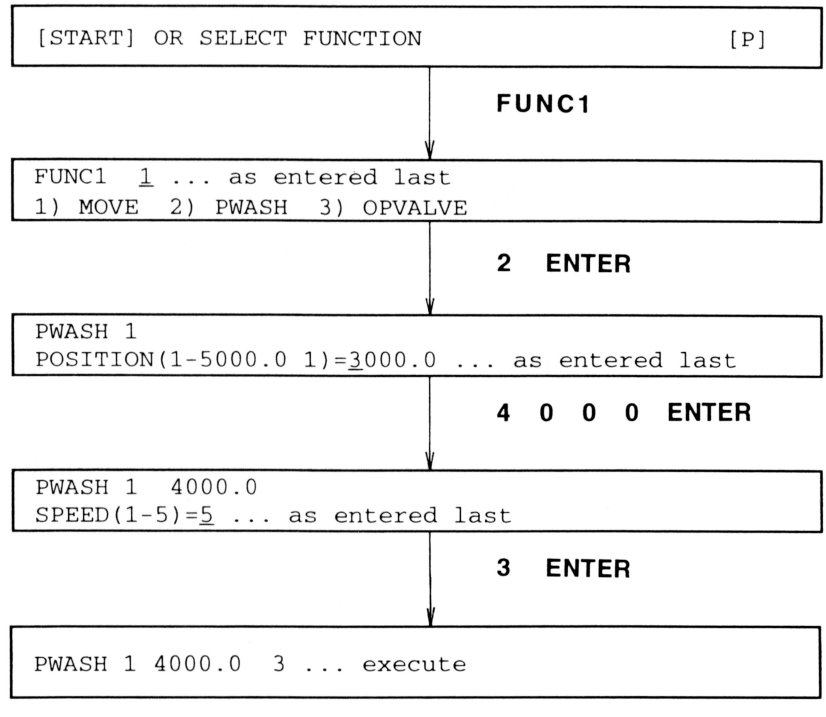
<Syringe speed> : 1-5

Example of use:

PWASH 1 4000.0 3 : Washes the pump plunger and seals using a syringe speed of 3 and with 4 ml of the autosampler wash solution.

Example of operation:

Input PWASH (in the direct execution mode).



The operation is the same in the TEACH mode or the EDIT mode.

Comment:

When using buffer solutions or salt-containing solutions as the eluents, the salts may precipitate on the pump plunger. When salts precipitate on the plunger, they lead to early wear of the plunger seal and damage of the pump plunger.

Use this command to avoid salt precipitation by washing the pump plunger area. Press the **FUNC1** key. From the prompt that appears select 2) PWASH.

Use PWASH to wash the pump plunger and seal after a series of analyses. Use the PWASH command as an effective daily pump maintenance tool.

Note:

To use the PWASH command, you need to have the optional plunger seal washing accessory installed in the pump. Connect the tubing that comes with the optional pump plunger wash unit to the autosampler syringe.

See the instruction manual of this accessory unit for installation details.

OPVALVE (option valve)*

Function:

Switches over the optional high-pressure valve. Use this command for applications that involve column switching, pre-concentration, and solid-phase extraction etc.

Format:

OPVALVE <valve position>

<Valve position> : 0, 1

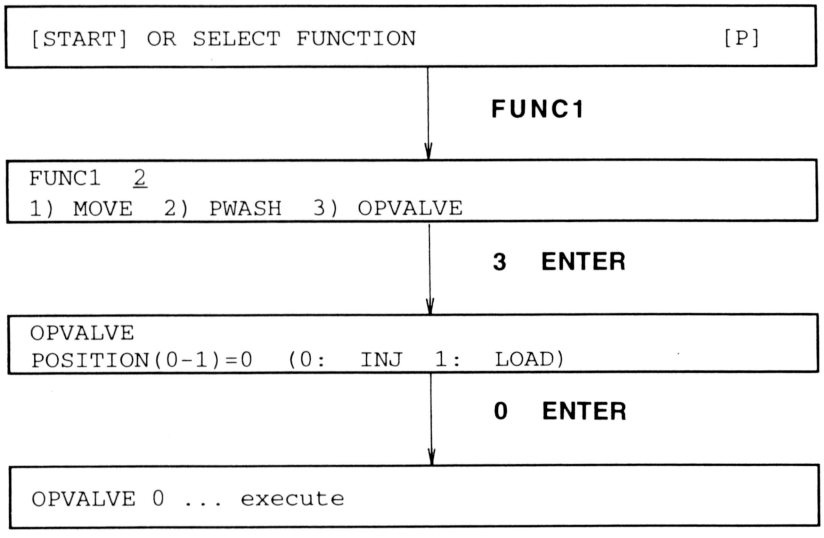
0: Selects the INJECT side.

1: Selects the LOAD side.

Example of use:

OPVALVE 0: Switches the optional valve to the INJECT side.

Example of operation:



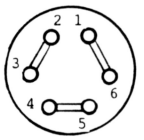
The operation is the same in the TEACH mode or the EDIT mode.

Comment:

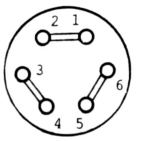
Use this command to switch the optional valve to the INJECT or LOAD side.

Press **FUNC1** key first to use this command. Then, select 3) OPVALVE from the command items displayed.

Finally, choose 0: INJ or 1: LOAD to select one of the two valve positions.



INJECT side



LOAD side

Note:

When you switch the valve from LOAD to INJECT and then back to LOAD, allow at least a 20 seconds lapse between the first and the second LOAD command. The instrument does not allow switching of the valve in less than 20 seconds. This time lapse protects the instrument.

LOAD SIDE
↓
INJECT side
↓
LOAD side

} About 20 seconds required.

1.9 How to Create Programs

1.9.1 Method for Feeding a Sample and a Reagent

There are three methods to transfer a specified amount of sample or reagent from one vial into another vial.
Each method applies to a specific analysis situation.

1. Single Method

This method does not dilute the sample and reagent with the washing liquid. Figure 1-9 illustrates this method.

1a. Aspirate air into the end of the needle, insert the needle into the vial that holds the sample or the reagent, and aspirate the sample or reagent.

1b. Move up the needle to aspirate a little air. The air prevents drops of liquid from falling out when moving the needle.

1c. Move the needle to the reaction vial and discharge the sample or reagent. At this moment, do not discharge the entire amount of the sample or the reagent, leave a little bit in the needle. The wash liquid dilutes the sample or reagent taken into the needle and into the tube. Since the part of the sample that is nearest the washing liquid is the one most affected, leave that part in the needle. That way the diluted liquid will not discharge into the receiving vial.

1d. Move the needle to the washing port. Use the washing liquid to wash the inside and outside of the needle.
Figure 1-10 shows the relationship between the aspirating amount and the discharging amount in the Single Method. In general, to reduce the amount of dilution, you need the residual amount (Vr) of the sample or reagent to be more than 10% of the amount you discharge.
That is, you should keep

$Vr > 0.1\ Vt$ ------- (1)

The amount of air (Vair) should be between 5 to 10 µl. This value should be large when there is an ample amount of sample and reagent.

Vair = 5 to 10 µl------ (2)

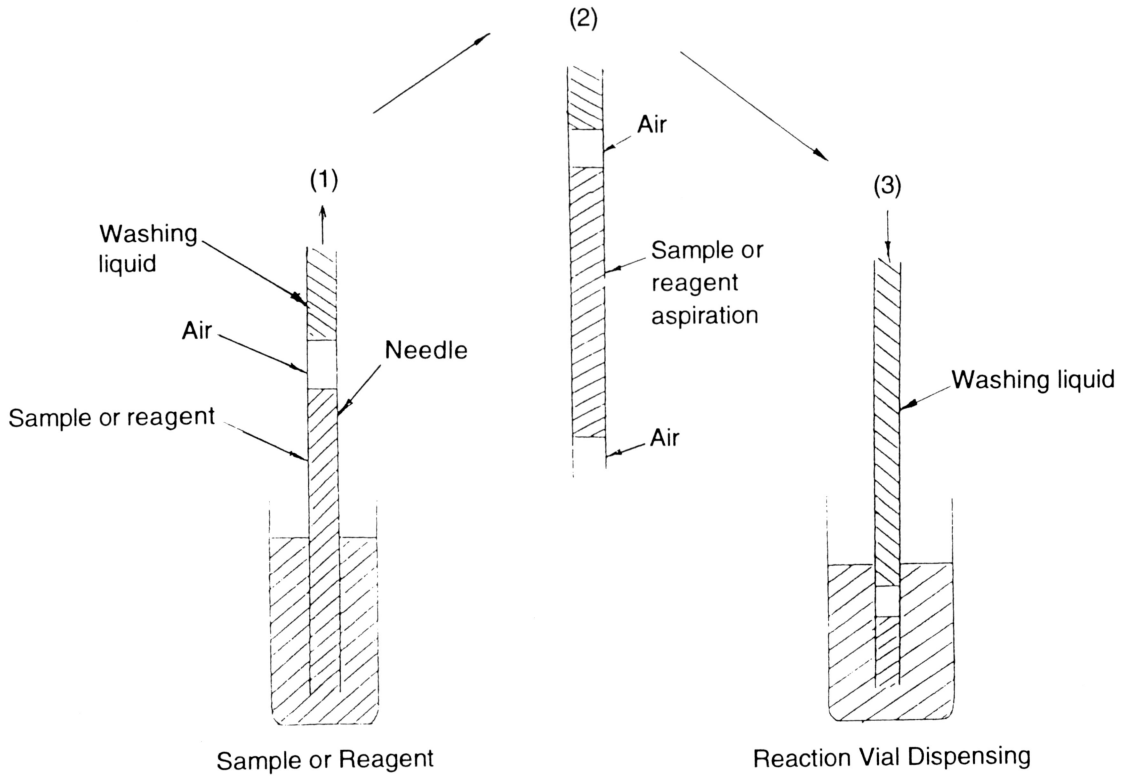


Figure 1-9 Single Method

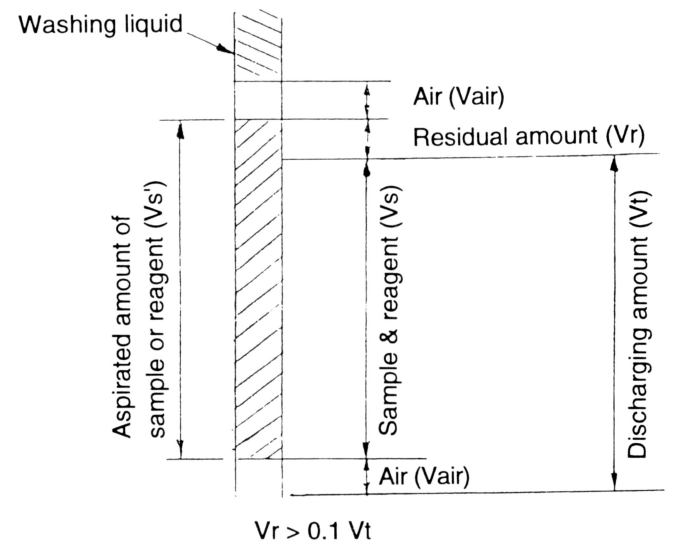


Figure 1-10 Aspirating Amount and Discharging Amount

2. Method of Diluting and Dispensing

Apply this method when dispensing minute amounts of sample. Figure 1-11 illustrates the dispensing procedure.

2a. Aspirate air at the end of the needle, then aspirate the sample or the reagent.

2b. Move up the needle and again aspirate air. Now move the needle to the reaction vial.

2c. Discharge the liquid held by the needle into the reaction vial. Now discharge at once the diluting liquid (as if it were a washing liquid).

2d. Wash the needle in the washing port.

Figure 1-12 shows the relationship between the aspirating amount and the discharging amount for the Method of Diluting and Dispensing.

To perform a complete discharge of the sample or the reagent into the reaction vial, you will need the volume of the diluting liquid (Vd) to be more than ten times the amount of sample or reagent (Vs). That is

$Vd > 10\ Vs$ ------ (3)

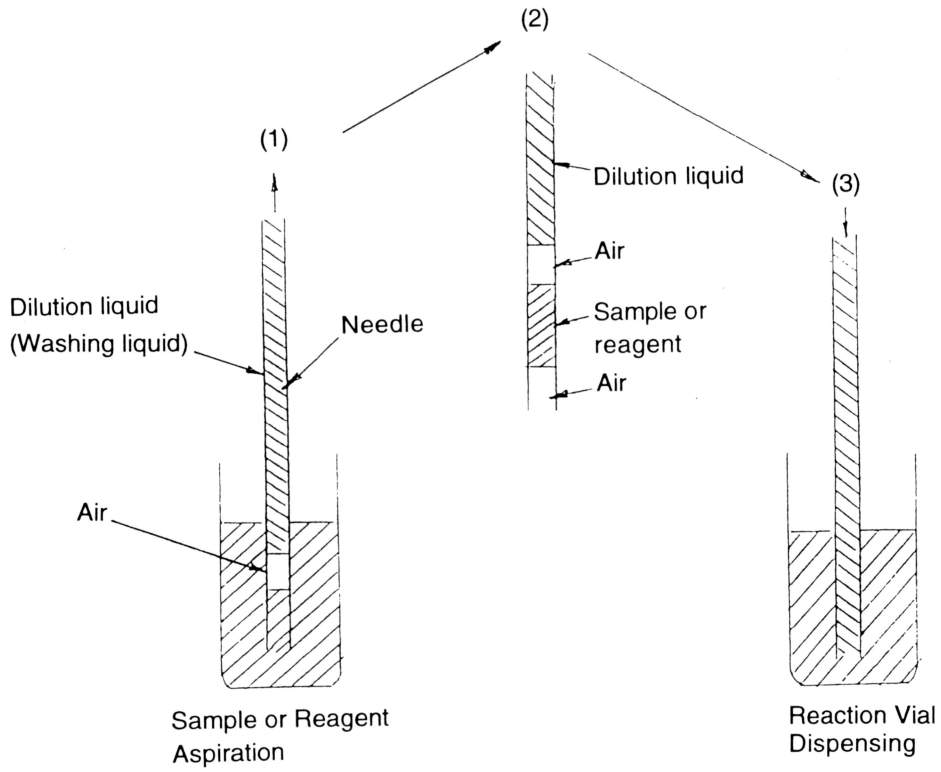
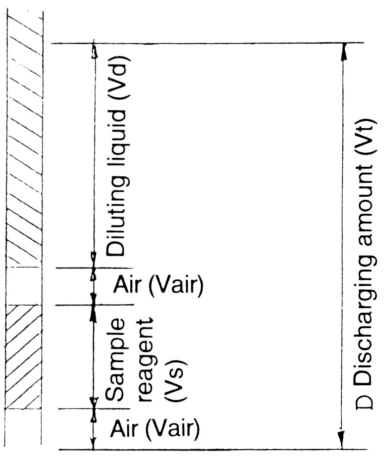


Figure 1-11 Diluting and Dispensing Method



Vd > 10 Vs

Figure 1-12 Aspirating Amount and Discharging Amount

3. Complex Dispensing Method

You need to apply a somewhat more complex dispensing method to mix a small amount of sample and a large amount of reagent. Figure 1-13 illustrates this dispensing method.

3a. Aspirate air at the end of the needle, then aspirate the liquid A.

3b. Move the needle up and aspirate air again. After aspirating air, move the needle to the vial for liquid B. Now, insert the needle into the washing port to wash the outside of the needle.

3c. Aspirate the liquid B into the needle.

3d. Move the needle up to aspirate air. Place the needle inside the reaction vial.

3e. Discharge the liquid held by the needle into the reaction vial. Leave a little bit of liquid A in the needle.

3f. Wash the needle in the washing port.

Figure 1-14 illustrates the relationship between the aspirating amount and the discharging amount when you use the complex dispensing method. In this method, the amount of liquid A (V_A) and the amount of liquid B (V_B.), the discharging amount (Vt) and the residual amount (Vr) should satisfy the following conditions.

$V_A > 10\ V_B$.

$Vr > 0.1\ Vt$

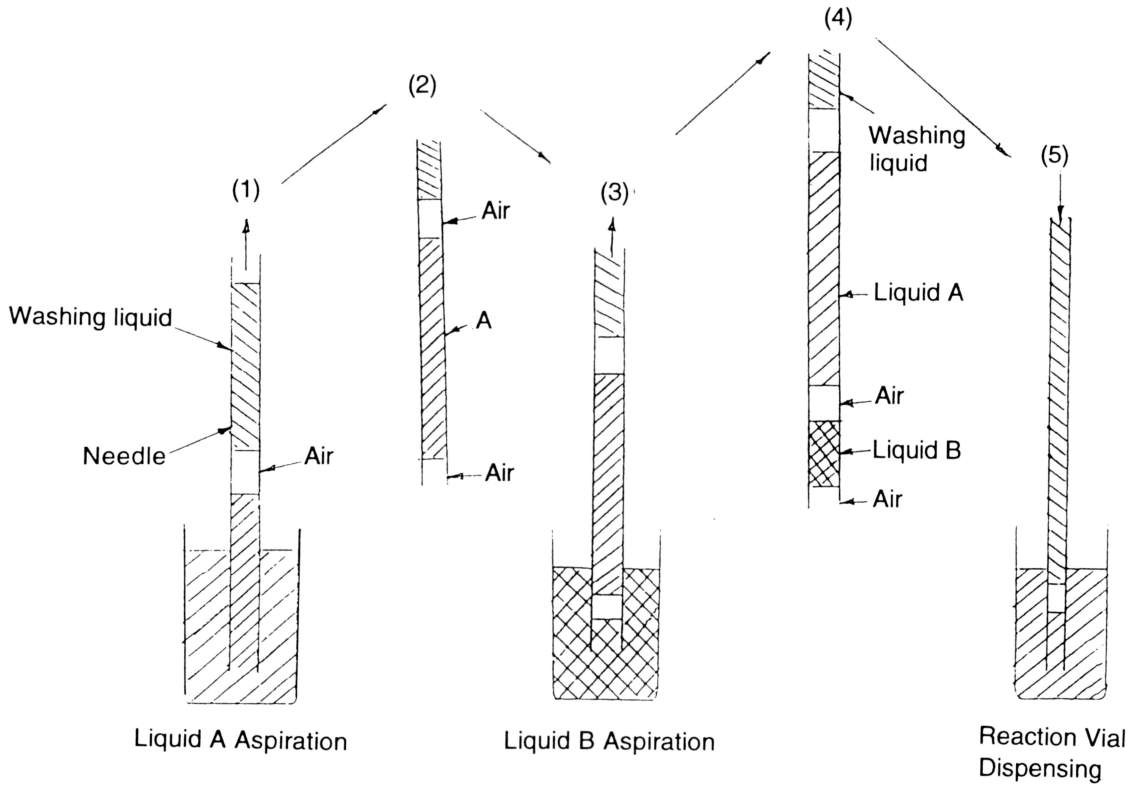


Figure 1-13 Complex Dispensing Method

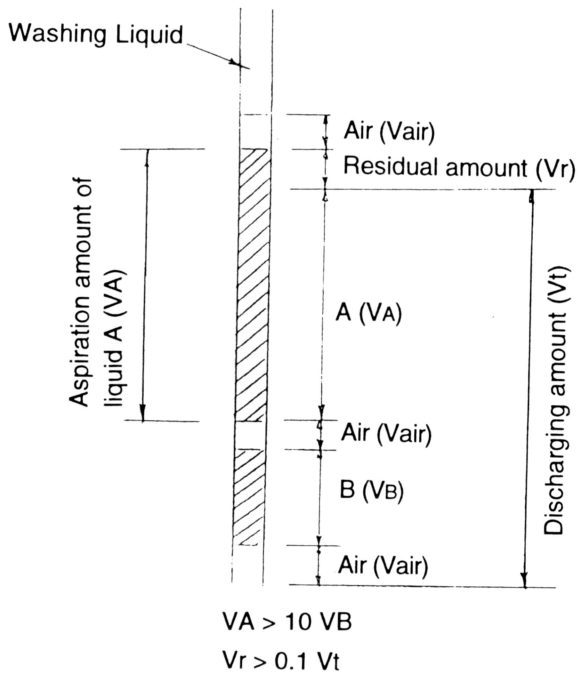


Figure 1-14 Aspirating Amount and Discharging Amount

1.9.2 Mixing Method

You should mix the dispensed and added sample and reagent. There are two kinds of mixing methods. One repeats the aspirating and discharging of the reaction liquid to create some turbulence, and the other discharges air from the end of the needle to mix the vial contents with bubbles.

1. Aspirating and Discharging Method

Insert the needle into the reaction vial, aspirate and discharge the reaction liquid to mix the vial contents. This mixing is done as follows:

1a. After dispensing the liquid, move the needle into the washing port and discharge the washing liquid to wash the needle.

1b. Lift the needle up and aspirate 30 to 100 µl of air.

1c. Put the needle inside the reaction vial and repeat the aspirating and discharging operation several times. Set the aspirating amount and discharging amount as large as possible, but remember the capacity limit of the syringe you are using. Also select a high dispensing speed.

1d. Complete the mixing operation. Then, wash the needle in the washing port.

This mixing method is very effective when the volume of the reaction liquid is smaller than the syringe capacity.

2. Air Application Method

Begin by aspirating air in the needle. Place the needle inside the reaction vial and discharge the air to create turbulence and cause mixing.

2a. Complete the mixing operation. Move the needle into the washing port and discharge the washing liquid to wash the needle.

2b. Lift up the needle and aspirate as much air as possible.

2c. Place the needle inside the reaction vial and discharge the air. Mixing of the reaction liquid occurs when the bubbles rise in the liquid. If all the air discharges, the washing liquid might mix with the reaction liquid. So, it is preferable to leave a little bit of air in the needle.

2d. Lift up the needle to aspirate air, lower the needle and then repeat the air discharging action.

2e. Upon completion of the mixing action, wash the needle in the washing port.
This mixing method is effective when there are relatively large amounts of the reaction liquid. This method is more effective if the shape of the reaction vial lower end is narrower than its top part. However, you should not use this method in an analysis where oxidization of the sample by air can be a problem.

1.9.3 Other Notes

1. Mechanism Play Effect

All mechanisms have a certain amount of play. The mechanism play is the clearance between a bearing and a gear. If there is no play, the mechanism does not operate. In the syringe, an accurate measurement is impossible if its movement reverses due to its play. To avoid this play effect, the syringe must move without fail in one direction to perform an accurate measurement. In the example given in section 1.9.1, you aspirate air first then you measure the sample or the reagent. By taking up air first, the play in the mechanism does not have an effect on the measurement of the sample and can be ignored. The syringe moves without fail to an accurate position when taking a sample or reagent.

2. MOVE and TUBE Commands

The MOVE and TUBE commands move the needle to a particular vial. The TUBE command detects the presence of a vial. If there is a vial with an opening that is larger than the sensor, the autosampler sensor may not detect that vial. If the unit does not detect a vial, an error displays and the operation stops. When using vials with openings larger than the sensor, use the MOVE command. When you use the MOVE command, the vial sensing does not take place and the needle moves to a specified position even if there is not a vial.

3. ASP and DISP Commands

When you use the ASP command, liquid aspirates through the needle. The opposite occurs with the DISP command. The liquid discharges through the needle.

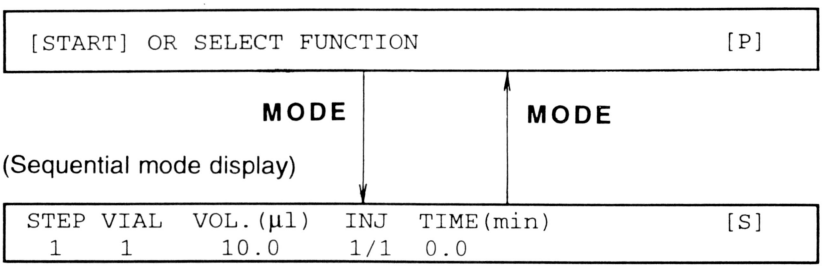
When you use the ASP command, the syringe capacity may prevent the liquid taken up by the needle from entering the syringe. With the DISP command, the above limitation does not apply. If the specified discharge amount is larger than the syringe capacity, the syringe and the syringe valve automatically repeat the operation to discharge the specified amount.

When you want to aspirate an amount of liquid that exceeds the syringe capacity, perform the aspiration operation under a program that combines steps. Use the SYRINGE command and the SVALVE command several times.

1.10 Sequential Mode

If you press **MODE** while on the programming mode initial display, you will switch to the sequential mode. The opposite occurs when you press **MODE** while on the sequential mode initial display. You will switch to the prgramming mode.

(Programming mode initial display)



2 EXTERNAL CONTROL

This section discusses connecting the Model L-7250 Autosampler to other peripheral units.

2.1 D-line Communication Function

The Model L-7250 Autosampler always comes with the D-line communication network function. When you configure a system using this network, diverse functions are available through a single cable.

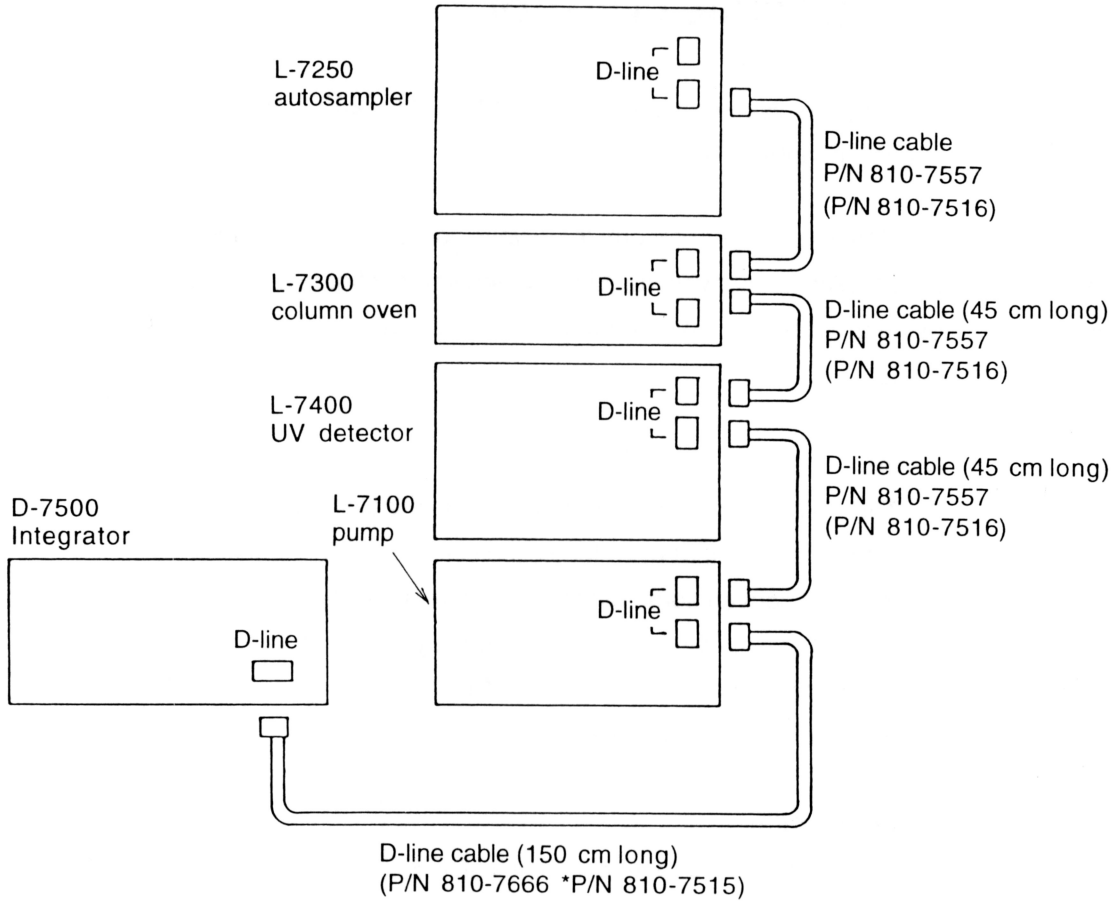
Notes:

1. The D-line communication network is available only among those modules that have the D-line communication function.
2. You can convert some of the D-line communication functions to contact signals through an optional relay box. In this case, the functions have some limitations. We will discuss the optional relay box and its capabilities later.

2.1.1 Installation

1. Connection

Figure 2-1 shows the required D-line cable connections.

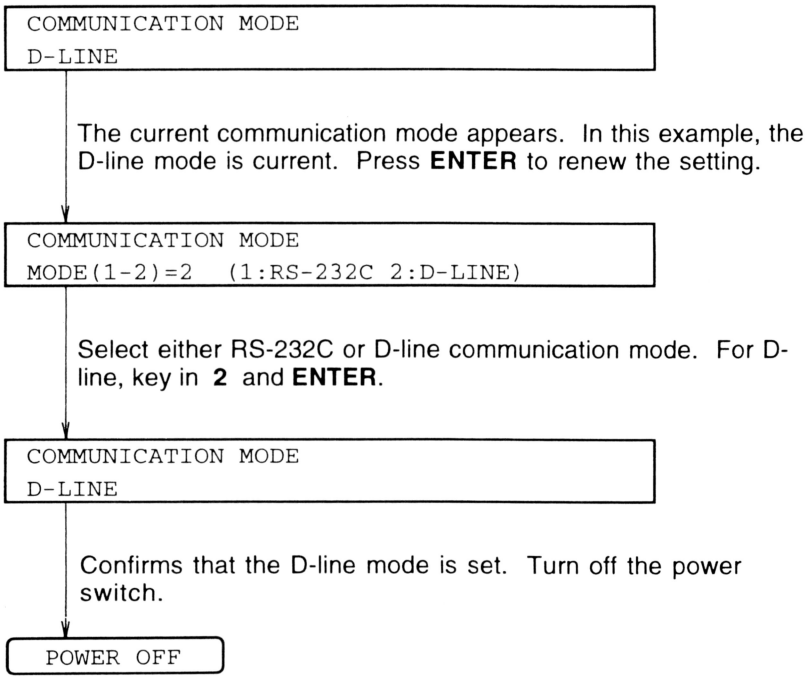


( ): For connection with the instrument bearing the CE conformity marking

Figure 2-1 D-line Cable Connection

2. Mode Setting

You can set the D-line communication mode parameters through the following procedure. First, turn on the POWER switch while pressing down on the **UTILITY (SETUP)** key. Keep this key down for several seconds until the initial screen appears. The communication mode setting screen follows the initial screen.



After the communication mode is set, be sure to turn off the power switch once.

Choose the RS-232C mode by the above procedure when you use the autosampler with a Hitachi data processor which does not have the D-line function or one that is produced by other companies.

Note: Once the D-line mode is set, it stays in memory after turning off the POWER switch.

2.1.2 Operating Method

When the Model D-7500 connects with the autosampler via the D-line, the operation follows these steps:

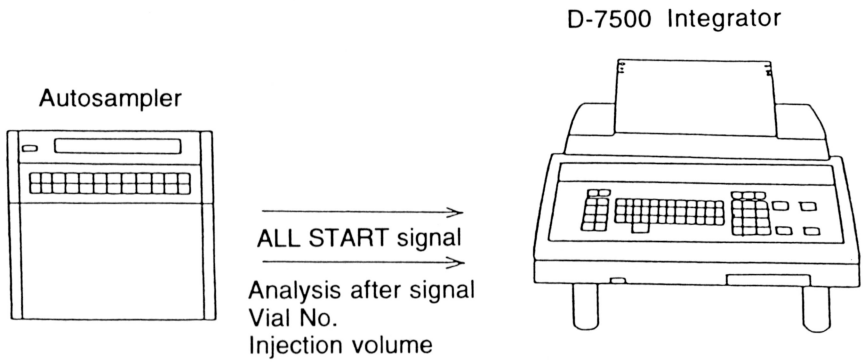


Figure 2-2 When Using the Analysis Table of the Model L-7250

1. Define the sample injection conditions by using the **SET PROG** key of the autosampler.

2. Assign qualitative/quantitative analysis parameters to the Model D-7500 Integrator.
   Turn off SAMPLER TABLE OPERATION of **SPEC MODES**.

3. Press **START** at the autosampler.

4. Whenever a sample injects, the ALL START signal from the autosampler is sent to the Model D-7500 Integrator.
   You can interrupt data processing through the STOP signal of the TIME PROGRAM.

5. The D-7500 prints in its reports the vial number (Vial No.) and the injection volume (INJ-VOL) of the samples the autosampler injects.

   Refer to the Integrator Manual for details.

Notes:

1. The end time of the data acquisition is set by the STOP TIME of the Model D-7500.

   The autosampler cannot inject the next sample until it reaches its READY status. The autosampler does not achieve its READY status until the Model D-7500 completes the printout of the data processing report. The autosampler READY status can not occur until the integrator report ends even if the STOP TIME set on the Model L-7250 has been reached. The Model D-7500 Integrator will also wait to issue a READY status until it receives the STOP TIME of the Model L-7250 autosampler.
2. The Model D-7500 can not accept the START or the ALL START command of the Model L-7250, unless the Model D-7500 is in the READY status. Also, when 2 channels are in use in the Model D-7500 Integrator, the integrator can not accept the START signal of the Model L-7250 until both channels are in the READY status.

2.1.3 Precautions on the Use of the D-line Communication

1. For an Entire System

1a. There is no restriction on the order in which you power on the Model D-7500 and all other peripheral units.

> **⚠ CAUTION**
>
> 1. When you turn off and then on the power switch of the Model D-7500 after initialization of all peripheral units (L-7100 pump, L-7250 autosampler, L-7400 UV detector, etc.), the D-line communication is disabled because the information about the units that are connected to the Model D-7500 is erased. When turning off and then on the power supply of the Model D-7500, all of the other peripheral units should also be turned off and then on.
> 2. When you observe a D-line ERROR, be sure to turn off all units once, and then turn on all units once.

2. On the Autosampler

The autosampler does not accept the **QUICK SAMPLE** key while running analyses through the D-line communication.

3. After starting an analysis by pressing the **START** key on the autosampler, all keys remain inactive until the end of the analysis, except the **STOP** and **SET PROG** keys. The analysis continues until one of the following situations occur: (1) the unit detects an empty vial holder, (2) the program execution at the autosampler ends, or (3) you press the autosampler **STOP** key.

2.2 External Control through Contact Point Signals

2.2.1 Input/Output of Contact Point Signals

You can control the Model L-7250 Autosampler via its external contact (point) signals. The D-line cable provides the signals that an entire liquid chromatography system uses. In addition, you can access the input and output signals of the autosampler at an independent connector.

1. **Contact Signals in the D-line Cable**
   Table 2-1 lists the contact signals at the D-line cable. Use the optional relay box (part No. 810-7630) to access these signals.

2. **Independent Contact Signals**
   Besides the D-line signals, the Model L-7250 has independent contact signals. Table 2-2 lists these signals. You must prepare a cable to use these independent signals.

3. **Input/Output Ports**
   The L-7250 comes with Input/Output ports.
   You can control and use these ports by programs you write.

4. **RS-232C**
   You can use RS-232C to communicate with an external computer. However, you can not use D-line and RS-232C simultaneously. See Chapter 3 for details about the use of RS-232C communication.
   Figure 2-3 shows the signal position at the connectors.

Table 2-1 Contact Signals in the D-line Cable

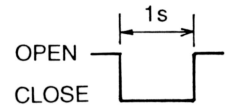
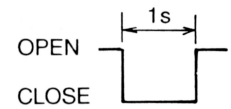
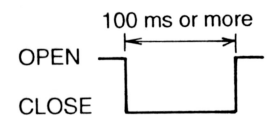
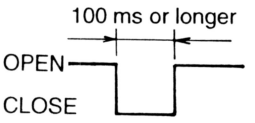
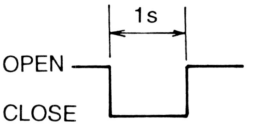
Name	Kind	Description	Signal
START	OUT	Issued when a sample is injected. Used for the start of a gradient program, or start of the data acquisition for the Integrator	
	IN	Unused in the autosampler.	
STOP	OUT	Issued when the unit detects an error such as an abnormal mechanical operation. When ALL END output is set via the UTILITY function, STOP OUT signal will be issued.	
	IN	Accepts an external stop signal. (Causes the same operation as the STOP key.)	
READY/BUSY	IN	Inhibits the start of the autosampler when other module is in the BUSY state.	OPEN : READY CLOSE: BUSY

Table 2-2 Independent Contact Signals

	Name	Description	Signal
Input (IN)	1. PROG. START IN	Starts program. Provides the same function as the **START** key.	
	2. A/S STOP IN	Accepts the stop signal from an external system. Provides the same function as the **STOP** key.	Same as above
	3. IN3	Used only in the programming mode.	
Output (OUT)	1. INJ. START OUT	Issued at completion of the sample injection. (Used for start of data acquisition by the Integrator, etc.)	
	2. OUT2	Used only in the programming mode.	
	3. OUT3	Used only in the programming mode.	

Notes: 1. Each function of the PROG. START IN and the A/S STOP IN signals is the same in the programming mode.

2. In the programming mode, a user-generated program can control all the contacts except for the PROG. START IN and the A/S STOP IN. (Use the WAITSIGNAL and OUT commands.)

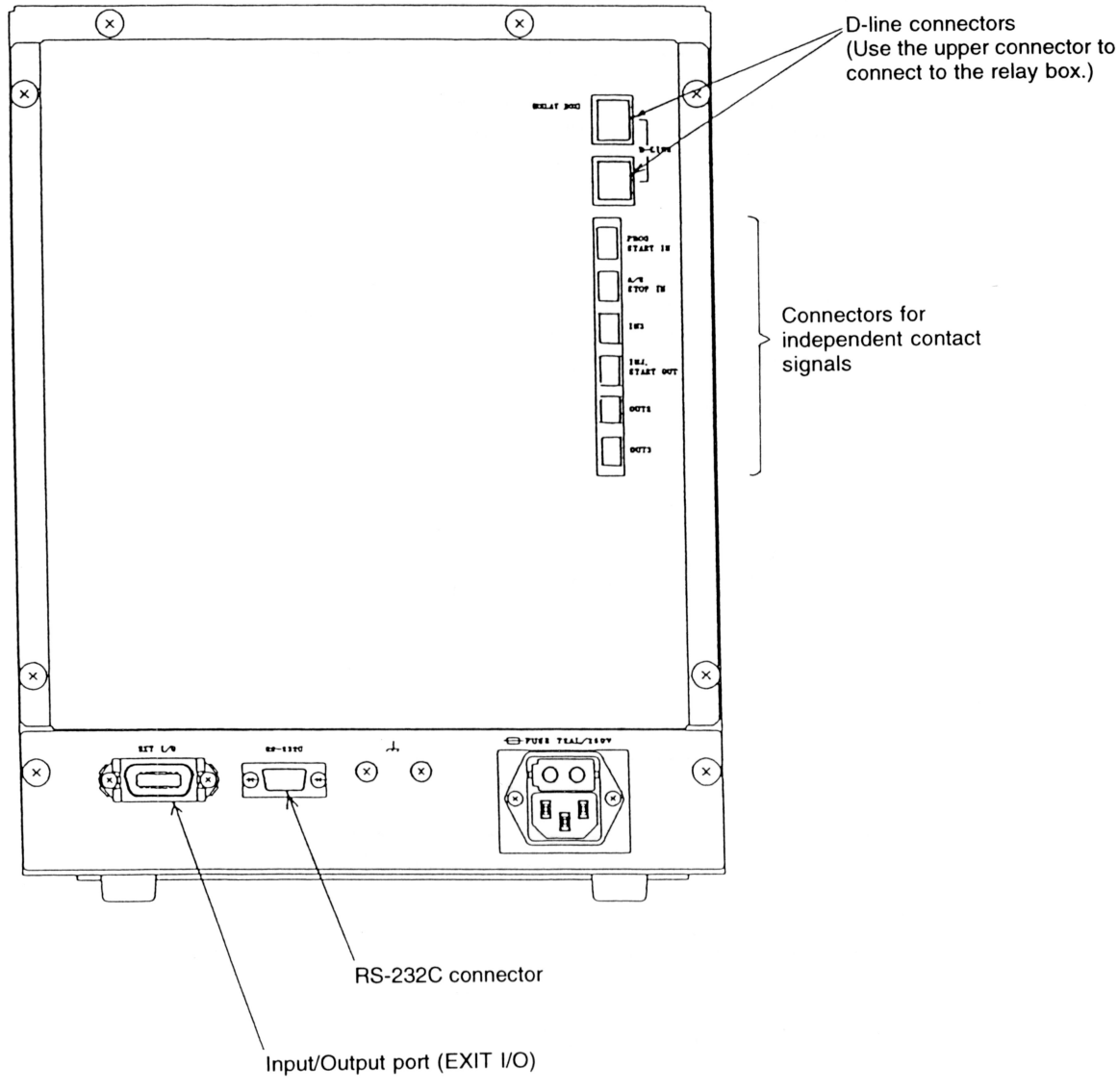


Figure 2-3 Connectors for External Control

2.2.2 Signal Inputs and Outputs in the Programming Mode

The L-7250 has input/output signal ports that you can control via a program.

Output port : There are 3 bits in the relay contact outputs and 5 bits in the TTL level outputs. You can control them through the "OUT" command and by designating levels and bit numbers.

Input port : There are 3 bits at the photocoupler of the input ports and 5 bits at the TTL level inputs. A program can wait for an in/out signal that meets certain requirements when the "WAIT" signal command designates levels and bit numbers.

You can connect an instrument that has an external start terminal to the contact output of an L-7250.

Figures 2-1 through 2-6 illustrate the signal inputs and outputs.

In the sequential mode, you can select these ports and contact signals of 3 input bits and 3 output bits.

Obtain the proper connecting cable. Make sure it meets the requirements of the connecting instrument to achieve proper operation.

2.2.3 Input/Output Circuits

1. Output Circuits

1a. Contact Outputs (bit numbers 1-3)

Bit number 1: INJ, START OUT
2: OUT 2
3: OUT 3

Maximum contact current: 0.5 A
(maximum contact rating: 10 W)

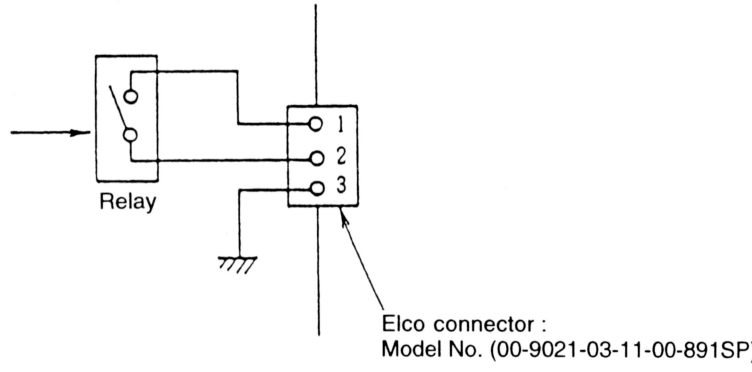


Figure 2-4 Contact Outputs

1b. TTL Level Outputs (bit number 4-8)

Bit number 4-8: EXT I/O

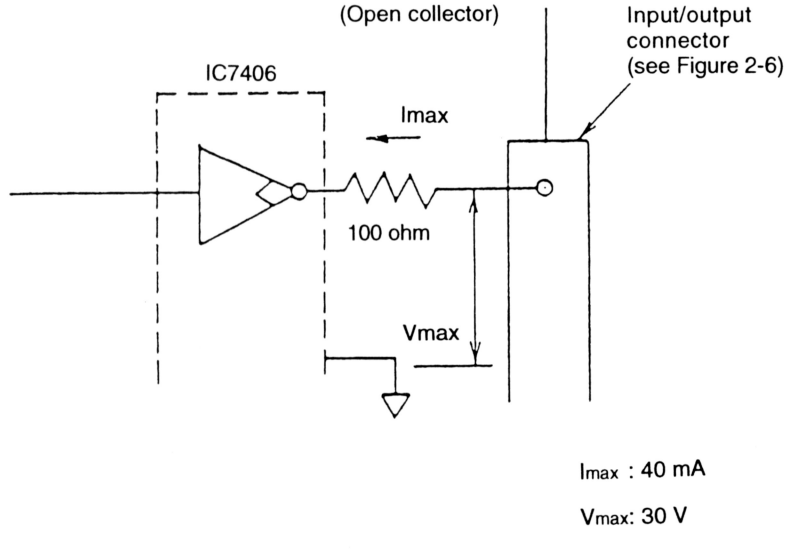


Figure 2-5 TTL Level Output

2. Input Circuits

2a. Contact Inputs (bit number 1-3)

Bit number 1: PROG START IN

2: A/S STOP IN

3: IN3

Photocoupler input

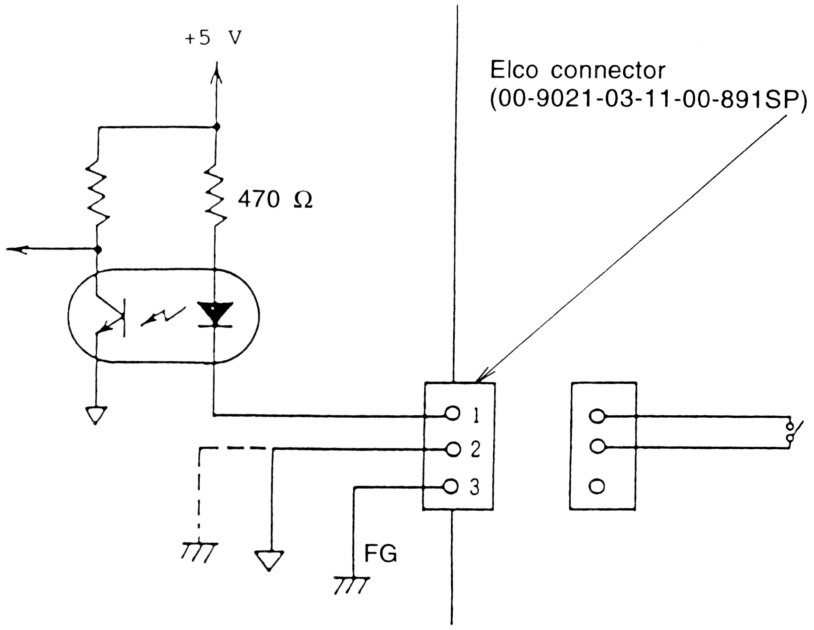


Figure 2-6 Contact Inputs

2b. TTL Level Inputs (bit numbers 4-8)

Bit number 4-8 : EXT I/O

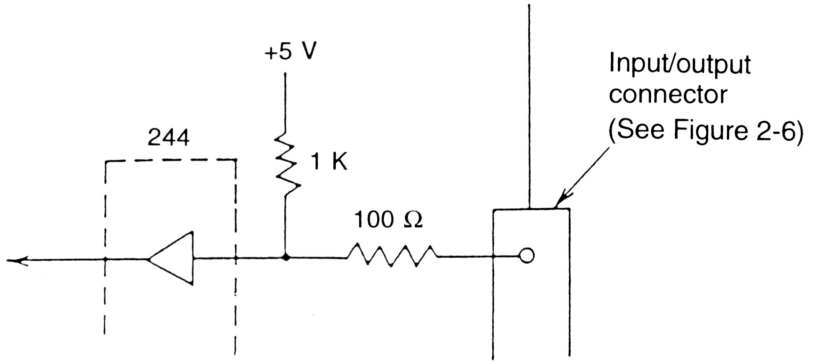


Figure 2-7 TTL Level Inputs

3. Details of the Input/Output Connector (EXT I/O)

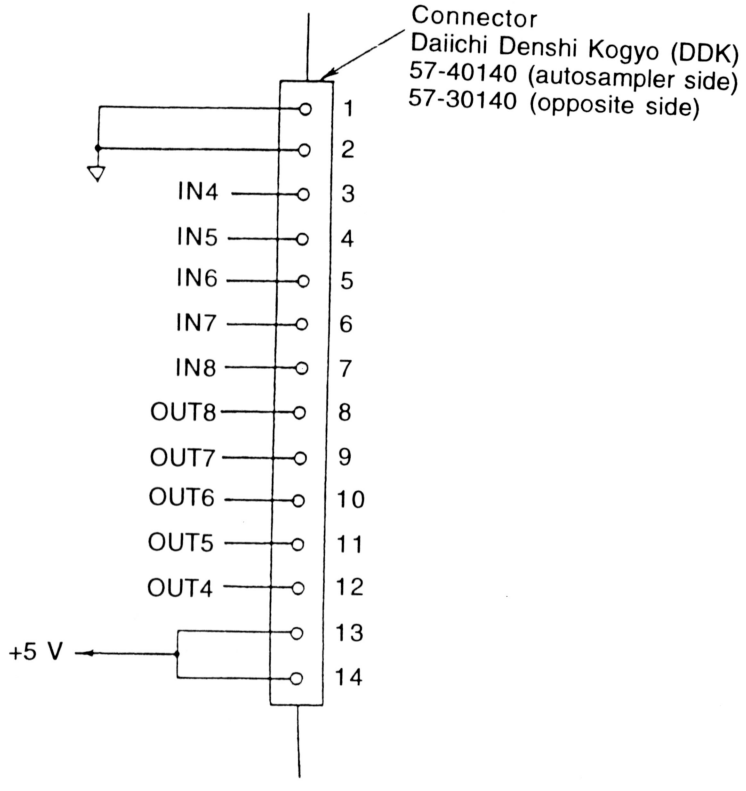


Figure 2-8 Input/Output Connector (EXT I/O)

3 COMMUNICATION FUNCTION VIA RS-232C

The L-7250 Autosampler always comes with a communication interface for RS-232C. In this chapter, we will describe this function.

Use of the communication interface enables the L-7250 Autosampler to connect and communicate with an external system such as a personal computer.

The external system can control the autosampler.

3.1 Connection with an External System

3.1.1 Setting of the Communication Mode

Use the following procedure to set the RS-232C communication mode parameters. First, turn on the POWER switch while pressing down on the UTILITY (SETUP) key. Keep this key down for several seconds until the initial screen appears. The communication mode setting screen follows the initial screen.

```
COMMUNICATION MODE
D-LINE
```

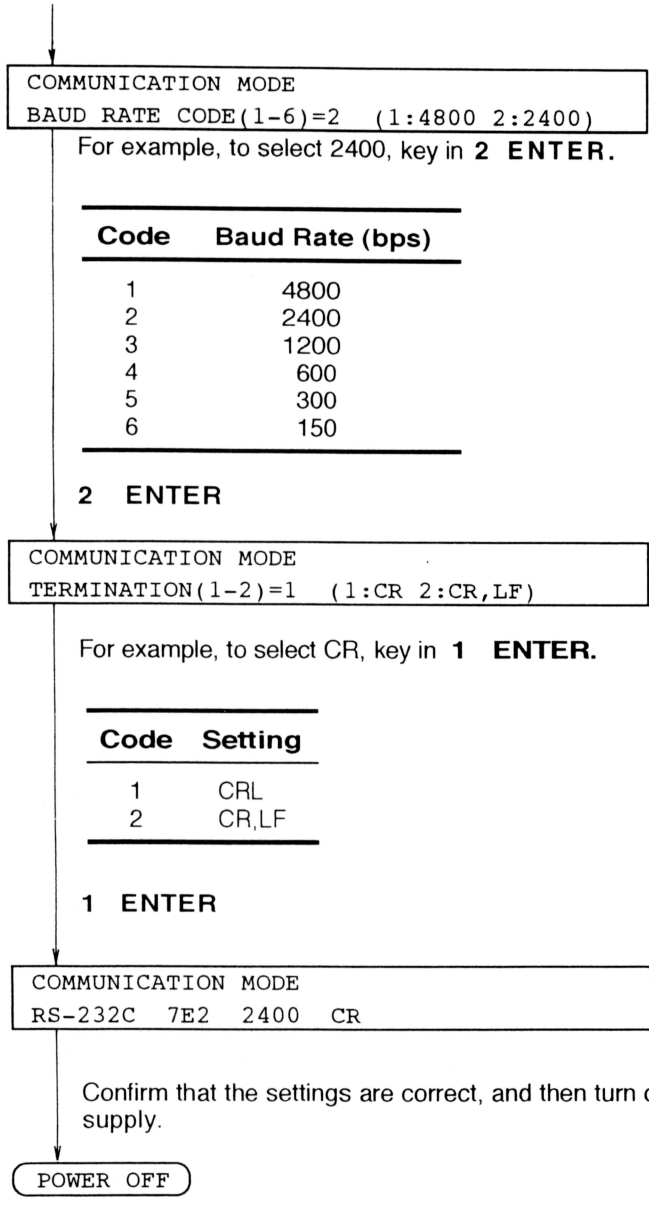
The unit displays the current communication mode. In this example, the D-line mode is set. Press **ENTER** to select a new setting.

```
COMMUNICATION MODE
MODE(1-2)=2   (1:RS-232C 2:D-LINE)
```

Select either RS-232C or D-line. For RS-232C, key in **1** **ENTER**
Then, the unit prompts you to set the conditions for the RS-232C communication.

```
COMMUNICATION MODE
DATA FORMAT(1-2)=1   (1:7E2 2:8N2)
```

Select the data format.
For 7E2 (7 data bits, even parity, 2 stop bits), select "1". Or select "2" for 8N2 (8 data bits, no parity, 2 stop bits).
For example, to select 7E2, key in the following:
1 ENTER



After setting the communication mode parameters, turn off the power switch once.

Note: The unit's memory retains the settings even after you turn the power switch off.

3.1.2 Communication Conditions

1. Input and Output Signal Contents

Table 3-1 lists the contents of the input and output signals in the RS-232C mode.

Table 3-1 Contents of the Input and the Output Signals in the RS-232C Mode

Pin No.	Signal Name	Contents of Signal
3	Tx DATA	Transmitted data
2	Rx DATA	Received data
7	RTS	Request to Send ..... ON (0) = sending requested
8	CTS	Clear to Send ..... ON (0) = sending enabled OFF (1) = sending inhibited
5	SG	Signal ground
6	DSR	Data Set Ready (only for the cable connection given in example 2)

2. Signal Level Specifications

2a. RS-232C Signals

Table 3-2 Specifications of the RS-232C Signals

Voltage	Data Signals (Tx DATA, Rx DATA)	Control Signals (CTS, DTR)
Positive (+3 V or more)	"0" (space)	ON (communication enabled)
Negative (-3 V or less)	"1" (mark)	OFF (communication inhibited)

2b. Bit Configuration Specifications

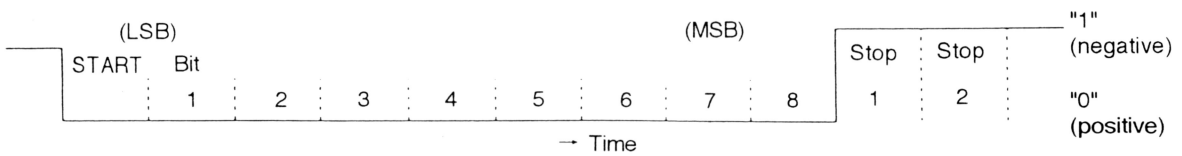
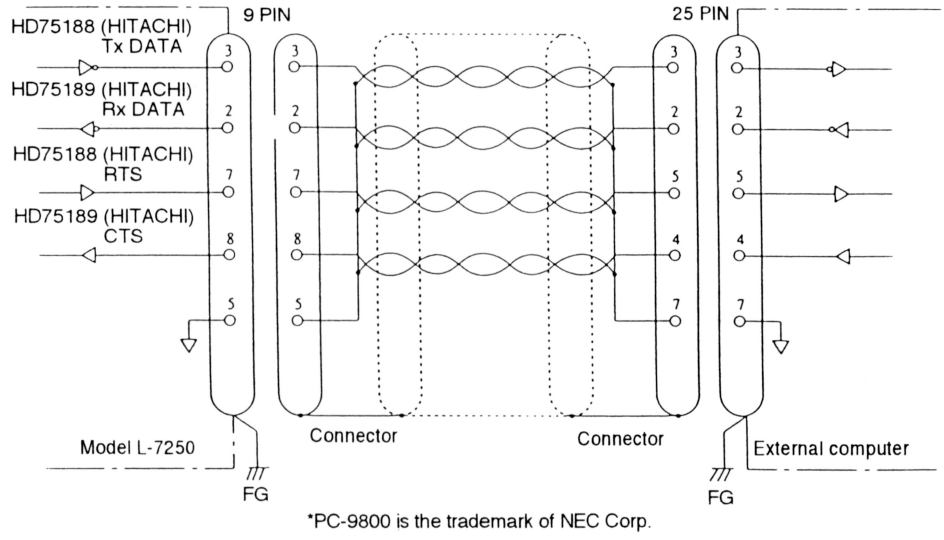


Figure 3-1 Bit Configuration

3.1.3 Typical Cable Connections

Figures 3-2 and 3-3 give the typical cable connections.

1. Use a 9-pin to 25-pin cable for connecting the Model L-7250 to the PC-9800*.



*PC-9800 is the trademark of NEC Corp.

Figure 3-2 RS-232C Connection Diagram (example 1)

2. Use a 9-pin to 9-pin cable to connect to an IBM AT series PC.

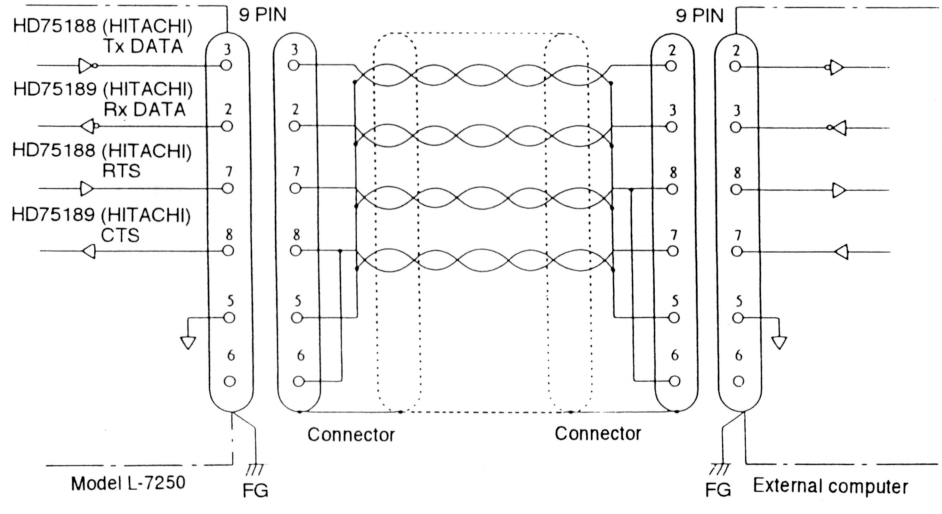


Figure 3-3 RS-232C Connection Diagram (example 2)

Note: Use the following parts to prepare the cable.

Plug : HDE-CTH(4-40) (made by Hirose Denki)

Connector : HDEB-9S (made by Hirose Denki)

3.2 Communication Method

3.2.1 Data Format

1. Characters Used During Transmit and Receive Operations

Both the transmit and the receive operations use ASCII codes. If you use other than ASCII codes, the unit will send error codes.

2. Text Format

In general, text is sent in the following format.

[Command] [Parameter 1]␣ ..... ␣[Parameter n][Terminator]

where,

[Command]	:	Section 3-3 gives the command specifications.
[Parameter i]	:	Parameters (numerical value) that belong to the [Command]
␣	:	Indicates a space.
[Terminator]	:	Sets either a C/R or, C/R and a L/F with the communication mode setting (see Section 3.1. 1.)

3.2.2 Communication Procedure

The following is an example of a procedure to control the autosampler from an external computer.

(1) Send the REMOTE command (remote mode start).
(2) Receive an "@" mark.
(3) Transmit an execution command.
(4) Receive the "@" mark.
(5)-1 To process in (6) after the data reception when the command involves data reception (example: PORTIN, FILEREAD, etc.)
-2 To process in (6) when the command does not involve data reception (example: TUBE, ASP, etc.)
(6)-1 Return to process in (3) if the autosampler control is in progress.
-2 To send the LOCAL command after an autosampler control (remote mode cancel).
Receive an "@" mark.

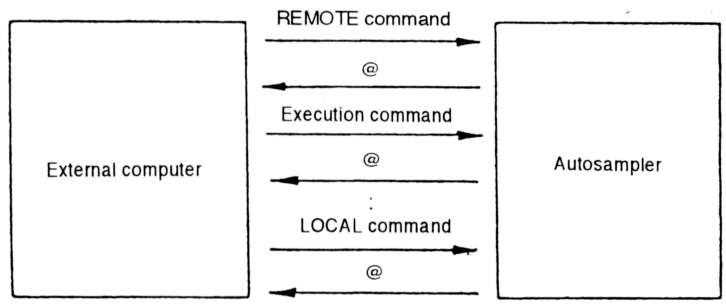


Figure 3-4 Communication Procedure

3.2.3 Error Remedy

The autosampler returns an error code using the format "? ␣ error code" when the command name, parameter, etc. are incorrect. Table 3-3 lists the error codes, the solution, and the probable cause.

Note: ␣... denotes a space.

Table 3-3 Error Codes

␣ ... Space

Data Format	Description	Relevant Command
?␣21	Communication error	All commands
?␣24	Current operation impossible	All commands
?␣41	Tube detection error	TUBE
?␣42	Parameter error (1) Beyond the effective range (2) Beyond the operable range	All commands
?␣46	A contact point stop signal was entered while executing a program and the program has stopped.	START
?␣51	No program exists in the editor buffer	PROGSAVE, START PROGREAD
?␣52	Command name error	All commands
?␣53	Parameter number error	
?␣54	(1) Editor buffer does not have an area available to add a program (2) Sequential file does not have an area to add a program	PROGWRITE FILEWRITE
?␣55	RAM disk does not have a file of the designated number	PROGLOAD
?␣56	RAM disk does not have an area available to save a program	PROGSAVE
?␣61	Arm X scale (sidewise) movement error	TUBE, MOVE, WASH, HOME
?␣62	Arm Y scale (crosswise) movement error	TUBE, MOVE, WASH, HOME
?␣63	Needle Z scale (vertical) movement error	TUBE, MOVE, HEIGHT, WASH, HOME
?␣64	Syringe movement error	ASP, DISP, WASH, HOME, SYRINGE
?␣65	Syringe valve movement error	SVALVE, HOME
?␣68	Injection valve error	VALVE
?␣69	Accessory error	Command for accessory (option)
?␣74	START STEP NO. set by the UTILITY function is not present in a sequential program.	START
?␣76	The syringe speed code set by the UTILITY function exceeds the code given in Table 2-4 of the BASIC OPERATION manual when using a 2.5 ml or a 5 ml syringe.	START

(cont'd)

Data Format	Description	Relevant Command
?␣72	Option valve movement error	OPVALVE
?␣77	Vial number setting error in a sequential program (1) The parameter is set at a vial number that is beyond the operable range (2) Vial numbers designation is in descending order (example: 20 5)	START
?␣78	In a sequential program, the injection volume is set beyond the operable range	START

Note: From the above error codes, errors 41, 42, 61 to 69 return to the external computer. The error sending occurs even when the START command is initiated by the execution of a program.

3.2.4 General Precautions for Transmission and Reception

1. Section 3.2.2 states that the communication between an autosampler and an external computer is of the "handshake type". That is, the autosampler returns an "@" mark when it receives a correct command from the external computer, or an error code when it is incorrect.
   In data reception, you must send an "@" mark from the external computer. If the external computer does not correctly receive the text sent by the autosampler due to communication failures, etc., sending a "?" mark from the external computer allows the sending unit to retransmit the same text again.
   If the computer sends a character other than an "@" or a "?" mark to the autosampler, the autosampler will ignore the data.

2. When data is sent and received with the relevant commands listed next, the time-out function works. The time-out function checks the transmission. If the autosampler does not receive data for 60 seconds, the autosampler LCD shows "ERROR-RS-232C TIME OUT!" and discontinues the remote mode. Press any key to clear the error message.

   (Relevant commands)
   PORTIN, PROGREAD, PROGWRITE, FILEREAD, FILEWRITE, PARAMREAD, PARAMWRITE, RACKREAD, RACKWRITE

3.3 Communication Commands

3.3.1 Communication Control Commands

REMOTE:

Sets the remote mode

(Format for transmission from an external computer)

REMOTE n [terminator]

When, n=1: Ordinary remote mode (only accepts the **STOP** key and cancels the remote mode)

n=2: Local lockout (does not accept any keys)

(Format for reception from an autosampler)

After setting, an @ [terminator] mark is sent back.

Note: If you enter a signal to STOP IN (the contact input No. 2 shown in Table 2-1), the remote mode cancels.

LOCAL:

Cancels a remote mode and selects the local mode.

(Format for transmission from an external computer)

LOCAL [terminator]

(Format for reception from an autosampler)

After setting, an @ [terminator] mark is sent back.

3.3.2 Hardware Control Commands

START:

Executes a sequential program when in the sequential mode.

Executes a program that is in the editor buffer when in the programming mode.

(Format for transmission from an external computer)

START [terminator]

(Format for reception from an autosampler)

After program execution, an @ [terminator] mark is sent back.

Important:

1. If you execute the sequential program with the START command while in the sequential mode, the autosampler goes into the END status upon completion of the program execution. (END shows in the LCD)
   In the END status, the autosampler does not accept subsequent commands. When this occurs, cancel the remote mode (issue the LOCAL command, or press the **STOP** key). Then, press any key to leave the END status. After returning to the initial screen, retry communication.

2. To control the autosampler with the communication commands even after execution of a sequential program, do the following:
   (1) In the programming mode, set the SEQINJ command only at step 1 using the **EDIT** function. Do not set any commands after step 2.
   (2) In the communication process, select the programming mode using the MODE command.
   Use the START command, to specify the parameters for running the SEQINJ command (sequential program execution command).
   (3) Specify parameters that will control the autosampler. Use commands that are transmitted sequentially after the execution of the SEQINJ command and after receipt of an @ mark.
   (4) Execute the communication program.

ASP:

Aspirates via the needle as much liquid as specified.

(Format for transmission from an external computer)

ASP␣[dilutor number]␣[aspiration volume]␣[aspiration speed][terminator]

where:

[Dilutor number] : 1 (fixed)

[Aspiration volume] : 0 to 5000.0 μl

[Aspiration speed] : 1, 2, 3, 4, 5

Low← →High

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Important:

1. If the aspiration volume exceeds a volume that the syringe plunger can take when it moves from the current position to the low limit, an error (?␣42) occurs.
   Designate the aspiration volume according to the capacity of the syringe you are using.
   Set the syringe capacity through the UTILITY function or the PARAMWRITE command.
2. The plunger high limit is reset by the SYRINGE command (Example: SYRINGE 1 0.0 5).
3. The syringe capacity setting must coincide with the capacity of the syringe you are using. Otherwise, the unit will not aspirate the correct volume.
   The actual aspiration volume is equal to <aspiration volume> × {(mounted syringe capacity)/(syringe capacity setting)}.
   Example: When the capacity of the syringe is 100 μl and the syringe capacity setting is 3 (1000 μl), and you execute ASP 1 100.0 5, the unit aspirates only 10 μl.
4. Set a dispensing speed within the range of 1 to 3 for a 2.5 ml syringe and 1 to 2 for 5 ml.
   If you set the speed out of the range, a parameter error (?␣42) is sent back.

DISP:

Dispenses via the needle as much liquid as you specify.

(Format for transmission from an external computer)

DISP␣[dilutor number]␣[dispensing volume]␣[dispensing speed][terminator]

where:

[Dilutor number] : 1 (fixed)

[Dispensing volume] : 0 to 5000.0 μl

[dispensing speed] : 1, 2, 3, 4, 5

Low← →High

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Important:

1. The syringe capacity setting must coincide with the capacity of the syringe you are using. Otherwise, the syringe will dispense an incorrect volume.

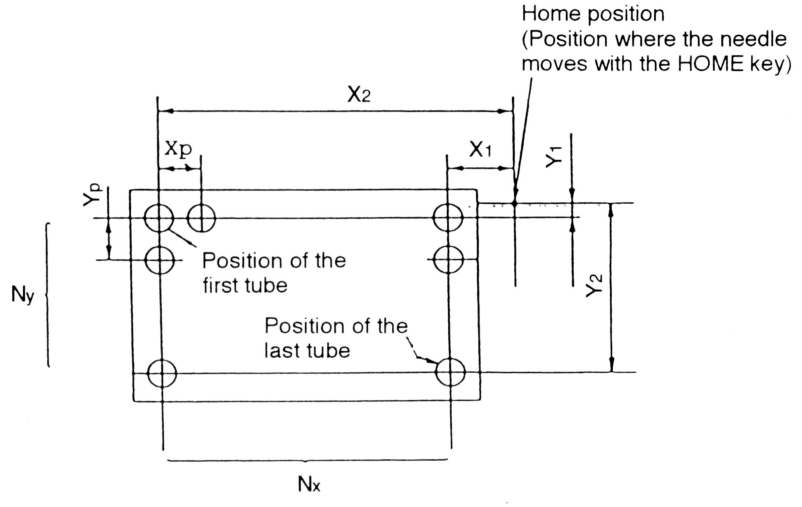
   The actual dispensing volume is equal to the <dispensing volume> × {(mounted syringe capacity)/(syringe capacity setting)}.

   Example: When the syringe capacity is 100 μl and the syringe capacity setting is 3 (1000 μl), executing DISP 1 100.0 5 dispenses only 10 μl.

2. Set a dispensing speed within the range of 1 to 3 for a 2.5 ml syringe and 1 to 2 for 5 ml. If the setting speed is out of range, the unit sends back a parameter error (?␣42).

TUBE:

1. Moves the needle to a designated vial number according to the rack parameter set by a specified rack code.
   (Contents of the rack parameter)
   (1) X_1 : x position of first tube
   (2) X_2 : x position of last tube
   (3) N_x : number of tubes on x scale
   (4) Y_1 : y position of first tube
   (5) Y_2 : y position of last tube
   (6) N_y : number of tubes on y scale
   (7) Z : needle height (distance from top point)
   (8) P : movement pattern



2. Moves the needle to the washing port or the injection port.
   (Format for transmission from an external computer)
   (1) TUBE␣[rack code]␣[tube number][terminator]
   where:
   [Rack code] : 1 to 16
   [Tube number] : 1 to 250
   (2) TUBE␣0␣[port number][terminator]
   where:
   [Port number] : 0 (washing port) or 1 (injection port)
   (Format for reception from an autosampler)
   After execution, an @ [terminator] mark is sent back.

Notes:

1. Before executing this command, set the rack parameter for the rack you are using through the UTILITY function or the RACKWRITE command.
2. Before executing this command, make sure that the rack parameter set for the rack code is for the rack you are using. Otherwise, the needle moves to an unintended position. An error (?␣42) occurs if the vial position exceeds the values given next. This error occurs even when the test tube number is within the range of 1 to 250.
   - x position exceeds 156.0 mm.
   - y position exceeds 156.0 mm.
3. The autosampler performs a tube detection function when the needle moves to the position and height specified by the rack parameter. If there is not a tube, the unit displays error (?␣41).

HEIGHT:

Moves the needle to the specified height (distance from uppermost point).

(Format for transmission from an external computer)

HEIGHT␣[height]␣[moving speed][terminator]

where:

[Height] : 0 to 57.0 mm (distance from the uppermost point)

[Moving speed] : 1 (low) or 2 (high)

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

⚠ CAUTION
When you execute this command, the autosampler does not perform a tube (vial) detection function. Be careful not to damage the needle.

VALVE:

Switches the injection valve to INJECT or LOAD.

(Format for transmission from an external computer)

VALVE ␣ [valve position][terminator]

where:

[Valve position]: 0 (INJECT side) or 1 (LOAD side)

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

PORTIN:

Reads the bit information (8 bits) of an input port from the autosampler. Table 3-4 shows the signal transfer between an external computer and the autosampler.

Table 3-4

External Computer	Signal Direction	Autosampler
PORTIN [terminator]	→	
	←	@ [terminator]
	←	PORT I_1 I_2 ... I_8 [terminator]
@ [terminator]	→	

where,

I_1 I_2 ... I_8 : level of each bit

Ii = 0 : LOW

= 1 : HIGH

Notes:

1. I_1 I_2 ... I_8 denotes eight ASCII code 0's or 1's.
2. After receiving data (PORT I_1 I_2 ... I_8), the unit transmits an @ mark to the autosampler.
   If the autosampler does not receive an @ mark within 60 seconds, the autosampler displays "ERROR-RS-232C TIME OUT!" on the LCD and cancels the remote mode.

OUT:

Set a chosen bit of the output port to a designated level (LOW or HIGH).

(Format for transmission from an external computer)

OUT␣[bit number]␣[level][terminator]

where:

[Bit number] : 1 to 8

[Level] : 0 (LOW) or 1 (HIGH)

(Format for reception from an autosampler)

After setting, an @ [terminator] mark is sent back.

MOVE:

Moves the needle to absolute positions on the X, Y and Z scales with respect to the home position (0, 0, 0).

(Format for transmission from an external computer)

MOVE␣[X position]␣[Y position]␣[Z position][terminator]

where:

[X position] : 0 to 156.0 mm (sidewise)

[Y position] : 0 to 156.0 mm (crosswise)

[Z position] : 0 to 57.0 mm (vertical)

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Important:

When you execute this command, the autosampler does not perform a tube (vial) detection function. Be careful not to damage the needle.

SYRINGE:

Moves the syringe plunger to a specified position.

(Format for transmission from an external computer)

SYRINGE␣[dilutor number]␣[position]␣[moving speed]

[terminator]

where:

[Dilutor number] : 1 (fixed)

[Position] : 0 to 5000.0 μl

[Moving speed] : 1, 2, 3, 4, 5

Low← →High

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Notes:

1. The syringe capacity setting must coincide with the current syringe capacity. Otherwise, the plunger will move to an incorrect position.

   The actual plunger position is equal to (plunger position designated by the SYRINGE command) × {(mounted syringe capacity)/(syringe capacity setting)}.

   Example: When a mounted syringe capacity is 100 μl and syringe capacity setting is 3 (1000 μl), executing SYRINGE 1 100.0 5 sets the plunger to a position where only 10 μl are taken from the high limit.
2. An error (?␣42) occurs if the SYRINGE command <position> is greater than the syringe capacity setting (Example: SYRINGE 1 500.0 5 is executed with set value of 100 μl).
3. Use a speed of 1 to 3 when using a 2.5 ml syringe, and 1 to 2 when using a 5 ml syringe. When setting a speed that is out of the range, a parameter error (?␣42) is sent back.

SVALVE:

Switches the syringe valve to the needle or bottle side.

(Format for transmission from an external computer)

SVALVE␣[dilutor number]␣[position][terminator]

where:

[Dilutor number] : 1 (fixed)

[Position] : 0 (bottle side) or 1 (needle side)

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

SNGLINJ:

Injects the specified sample volume only once under the injection conditions selected for the sequential mode.

(Format for transmission from an external computer)

SNGLINJ␣[rack code]␣[test tube (vial) No.]␣[injection volume] [terminator]

where:

[Rack code] : 1 to 16

[Test tube (vial) No.] : 1 to 250

[Injection volume] : 0 to 4000.0 μl

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

HOME:

Returns the needle and other mechanisms to the home position.

(Format for execution from an external computer)

HOME [terminator]

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

WASH:

Moves the needle to the washing port and dispenses the washing liquid. It also washes the injection port and the syringe.

(Format for transmission from an external computer)

WASH [terminator]

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Notes:

1. Upon completion of the execution of this command, the plunger of the syringe is set at a position where it aspirates a 5 μl volume.
2. When using 0.1 ml to 1.0 ml syringes, the system operates with a syringe speed code of 5. When using a 2.5 ml syringe, the system operates with a syringe speed code of 3. When using a 5 ml syringe, the system operates with a syringe speed code of 2.

MODE:

Switches to the programming mode or the sequential mode.

(Format for transmission from an external computer)

MODE n [terminator]

where:

n = 0 : programmable mode

n = 1 : sequential mode

(Format for reception from an autosampler)

After setting, an @ [terminator] mark is sent back.

PWASH:

Washes the plunger and the plunger seal of the pump

(Format for transmission from an external computer)

PWASH␣[dilutor number]␣[aspiration volume]␣[syringe speed] [terminator]

where:

[Dilutor number] : 1 (fixed)

[Aspiration volume] : 0 to 5000.0 μl

[Syringe speed] : 1 to 5

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

OPVALVE:

Changes the position of the option valve.

(Format for transmission from an external computer)

OPVALVE␣[valve position] [terminator]

where:

[Valve position]: 0 (INJECT side), 1 (LOAD side)

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

3.3.3 File Control Commands

The autosampler files exist in the following locations:

Editor buffer	:	area where a program is stored during execution or editing
RAM disk	:	area where programs are filed
Parameter file	:	area for 16 control parameters related to a measurement. For example, rack parameter or syringe speed
Sequential program file	:	area where programs set for the sequential mode are stored

Figure 3-6 outlines the use of the file command functions. An explanation of the file commands follows.

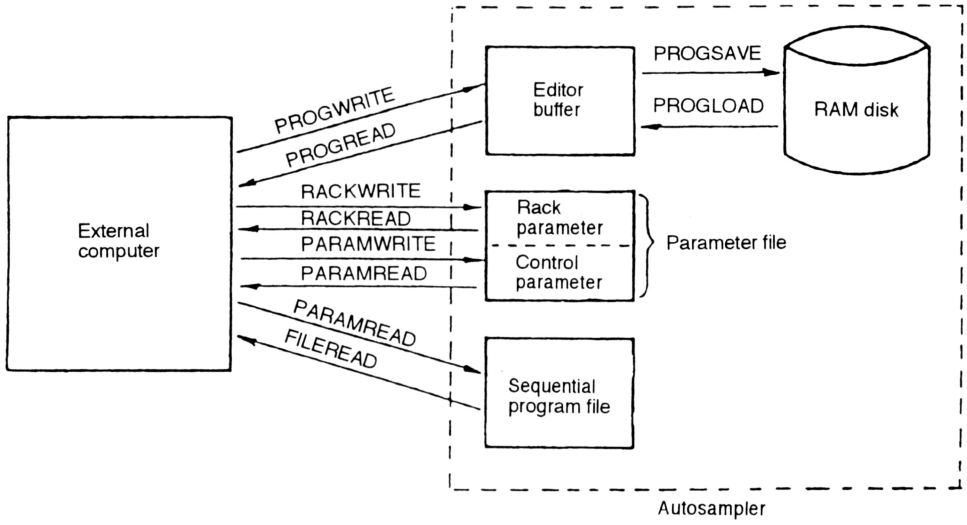


Figure 3-6 File Control Commands Functions

PROGREAD:

Transfers a program from the editor buffer to an external computer. The program transfer must follow the order comment, variables, and program (command). Table 3-5 shows the signal transfers between an external computer and an autosampler with the PROGREAD command.

Table 3-5

External Computer	Signal Direction	Autosampler
PROGREAD [terminator]	→	
	←	@ [terminator]
	←	Comment [terminator]
@ [terminator]	→	
@ [terminator]	←	Variable 1 (I1) data [terminator]
⋮	→ ⋮	⋮
@ [terminator]	→	⋮
	←	Variable 20 (I20) data [terminator]
@ [terminator]	→	
@ [terminator]	←	1st program step [terminator]
⋮	→ ⋮	⋮
@ [terminator]	→	⋮
	←	Last program step [terminator]
@ [terminator]	→	
	←	END [terminator]
@ [terminator]	→	

␣ ... Space

Example:

Contents of editor buffer

SAMPLER ..... program name (up to 10 characters)
10.0 ..... I1 contents
⋮
100.0 ..... I20 contents
HOME
TUBE␣1␣1
ASP␣1␣I1␣5 } Program
⋮
WASH } Last step

␣: Space

External Computer	Signal Direction	Autosampler
PROGREAD [terminator]	→	
	←	@ [terminator]
	←	SAMPLER [terminator]
@ [terminator]	→	
	←	10.0 [terminator]
@ [terminator]	→	
⋮	⋮	⋮
@ [terminator]	←	100.0 [terminator]
	→	
	←	HOME [terminator]
@ [terminator]	→	
	←	TUBE ␣ 1 ␣ 1 [terminator]
@ [terminator]	→	
⋮	⋮	⋮
@ [terminator]	←	ASP ␣ 1 ␣ I1 ␣ 5 [terminator]
	→	
	←	WASH [terminator]
@ [terminator]	→	
	←	END [terminator]
@ [terminator]	→	

␣ ... Space

Notes:

1. The autosampler sends an END statement after sending the last step of a program.
   This END indicates an end of the program transfer and it is not a command.
2. Transmit an @ mark within 60 seconds after receiving a data. If the autosampler does not receive an @ mark within 60 seconds after receiving the data, "ERROR-RS-232C TIME OUT!" shows in the LCD and the remote mode cancels.

PROGWRITE:

Transfers a program from an external computer to the editor buffer of an autosampler.

The transfer must follow the order of comment, variables and program (command).

Table 3-6 shows the signal transfers with this command between an external computer and an autosampler

Table 3-6

External Computer	Signal Direction	Autosampler
PROGREAD [terminator]	←	
	→	@ [terminator]
Comment [terminator]	←	
	→	@ [terminator]
Variable 1 (I1) data [terminator]	←	
	→	@ [terminator]
⋮	⋮	⋮
Variable 20 (I20) data [terminator]	→	
	←	@ [terminator]
1st program step [terminator]	→	
	←	@ [terminator]
⋮	⋮	⋮
Last program step [terminator]	→	
	←	@ [terminator]
END [terminator]	→	
	←	@ [terminator]

Notes:

1. Table 3-6 provides the order to send the data. After sending the last step of a program, transmit END. If END is not received within 60 seconds after transmitting an @ mark, "ERROR-RS-232C TIME OUT!" shows in the LCD of the autosampler and cancels the remote mode.
2. Transmit the data within 60 seconds after receiving an @ mark. If no data is received within 60 seconds, the autosampler shows "ERROR-RS-232C TIME OUT!" in the LCD and cancels the remote mode.
3. A program name should have no more than 10 characters. Otherwise, the unit truncates the name at the tenth character.

4. The variable I1 to I20 data and the command parameters you specify should be within the range given in Chapter 1. Otherwise, an error (?␣42) is sent back and the command processing is suspended. Note that the remote mode continues.
   The effective range of the variable I1 to I20 data is 0 to 99999.9.
   If an error occurs during variable data transmission, the contents of the editor buffer do not change. If an error occurs during a program (command) transmission, data that was present before the error replaces the data sent.
   If an error occurs, execution of the PROGWRITE command stops. You should issue the PROGWRITE command again.

PROGSAVE:

Saves programs from the editor buffer to the RAM disk.

(Format for transmission from an external computer)

PROGSAVE␣[program number][terminator]

where:

[Program number]: 1 to 30

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Notes:

1. If the file number already exists in the RAM disk, data is overwritten.
2. An error (?␣51) occurs if no program exists in the editor buffer.
3. An error (?␣56) occurs if the RAM disk does not have a continuous area for storing the program from the editor buffer. Cancel the remote mode, perform DELETE or CONDENSE processing through the **FILE** function and then execute the PROGSAVE command again.

PROGLOAD:

Loads in the editor buffer a program that is in the RAM disk.

(Format for transmission from an external computer)

PROGLOAD␣[program number][terminator]

where:

[Program number]: 1 to 30

(Format for reception from an autosampler)

After execution, an @ [terminator] mark is sent back.

Notes:

1. If the RAM disk does not have a program with that program number, an error (?␣55) occurs.
2. When you execute PROGLOAD, the program you load replaces the one in the editor buffer.

RACKREAD:

Transfers the rack parameters for a rack code (1 to 16) from the parameter file to the external computer.

Table 3-7 shows signal transfers between an external computer and an autosampler.

Table 3-7

External Computer	Signal Direction	Autosampler
RACKREAD n [terminator]	→	
	←	@ [terminator]
	→	1st parameter [terminator]
@ [terminator]	→	
	←	2nd parameter [terminator]
⋮	⋮	⋮
@ [terminator]	→	
	←	8th parameter [terminator]
@ [terminator]	→	

where:

n: rack code (1 to 16)

1st parameter : x_1 (0 to 156.0 mm)

2nd parameter : x_2 (0 to 156.0 mm)

3rd parameter : N_x (1 to 20)

4th parameter : y_1 (0 to 156.0 mm)

5th parameter : y_2 (0 to 156.0 mm)

6th parameter : N_y (0 to 20)

7th parameter : Z (0 to 57.0 mm)

8th parameter : P (1 to 16)

(Contents of rack parameters)

(1) X_1 : x position of first tube

(2) X_2 : x position of last tube

(3) N_x : number of tubes on x scale

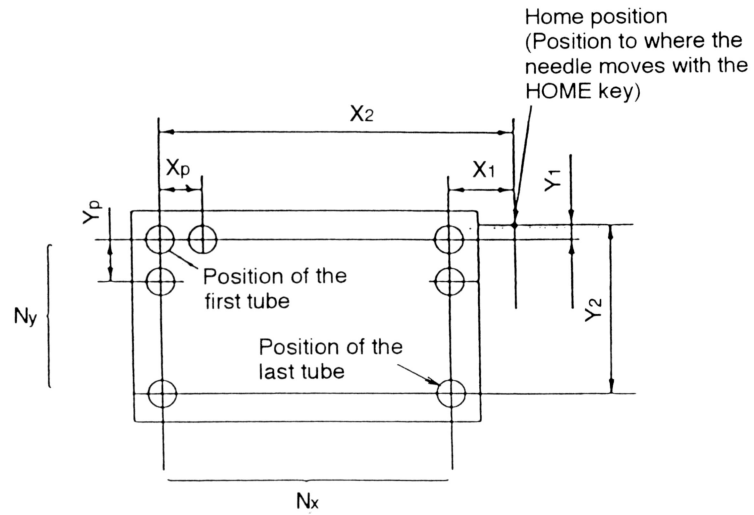
(4) Y_1 : y position of first tube

(5) Y_2 : y position of last tube

(6) N_y : number of tubes on y scale

(7) Z : needle height (distance from top point)

(8) P : movement pattern



Note: Transmit @ mark within 60 seconds after receiving a data. If the autosampler does not receive an @ mark within 60 seconds after transmitting the data, it displays "ERROR-RS-232C TIME OUT!" in the LCD and cancels the remote mode.

RACKWRITE:

Transfers the rack parameters for rack code (1 to 16) from an external computer to the parameter file of the autosampler. Table 3-8 shows the signal transfers between an external computer and an autosampler with the RACKWRITE command.

Table 3-8

External Computer	Signal Direction	Autosampler
RACKREAD n [terminator]	→	
	←	@ [terminator]
1st parameter [terminator]	→	
	←	@ [terminator]
2nd parameter [terminator]	→	
⋮	←	@ [terminator]
⋮	⋮	
⋮	←	@ [terminator]
8th parameter [terminator]	→	
	←	@ [terminator]

␣ .....Space

where:

n: rack code (1 to 16)

1st parameter : X_1 (0 to 156.0 mm)

2nd parameter : X_2 (0 to 156.0 mm)

3rd parameter : N_x (0 to 20)

4th parameter : y_1 (0 to 156.0 mm)

5th parameter : y_2 (0 to 156.0 mm)

6th parameter : N_y (0 to 20)

7th parameter : Z (0 to 57.0 mm)

8th parameter : P (1 to 16)

(Contents of rack parameters)

(1) X_1 : x position of first tube

(2) X_2 : x position of last tube

(3) N_x : number of tubes on x scale

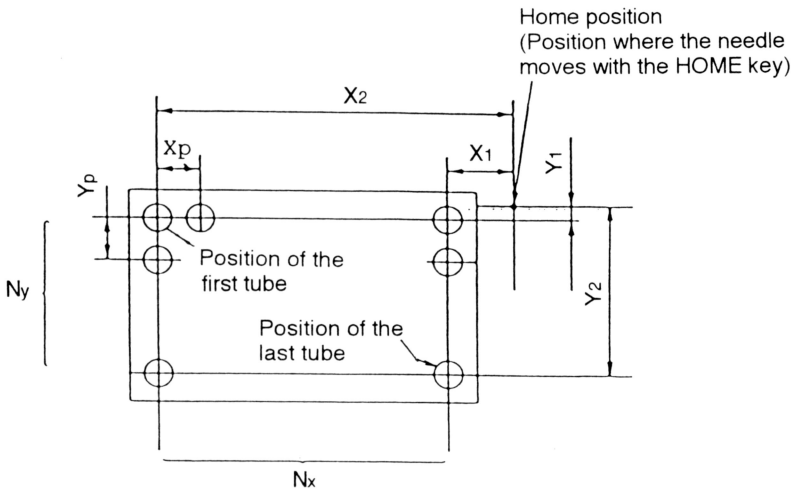
(4) Y_1 : y position of first tube

(5) Y_2 : y position of last tube

(6) N_y : number of tubes on y scale

(7) Z : needle height (distance from top point)

(8) P : movement pattern



Notes

1. Transmit the data in the order shown in Table 3-8.
2. Transmit data within 60 seconds after receiving an @ mark. If the autosampler does not receive data within 60 seconds, it displays "ERROR to RS-232C TIME OUT!" in the LCD and cancels the remote mode.

PARAMREAD:

Transfers 16 different control parameters from the parameter file to an external computer.

Table 3-9 shows signal transfers between an external computer and an autosampler with the PARAMREAD command.

Table 3-9

External Computer	Signal Direction	Autosampler
PARAMREAD [terminator]	→	
	←	@ [terminator]
	←	1st parameter [terminator]
@ [terminator]	→	
	←	
	←	2nd parameter [terminator]
	⋮	⋮
@ [terminator]	→	
	←	16th parameter [terminator]
@ [terminator]	→	

where:

1st parameter : Standard calibration to be performed (0: not measured, 1: measured)

2nd parameter : Number of unknown samples to be measured between standards (1 to 250)

3rd parameter : Employed rack code (1 to16)

4th parameter : Syringe speed (1 to 5)

5th parameter : Injection method (1: CUT injection, 2: ALL volume injection, 3: Full Loop injection)

6th parameter : LEAD VOLUME (0 to 1000.0 μl)

7th parameter : REAR VOLUME (0 to 1000.0 μl)

8th parameter : FEED VOLUME (0 to 1000.0 μl)

9th parameter : WASTE VOLUME (0 to 4000.0 μl)

10th parameter : Number of times for needle washing (1 to 20.0)

11th parameter : NEEDLE WASH SPEED (1 to 5)

12th parameter : Number of injection port washings (0 to 20.0)

13th parameter : INJECTION PORT WASH SPEED (1 to 5)

14th parameter : PUMP PLUNGER WASH (0: NO, 1: YES)

15th parameter : Syringe volume (1 to 5)
1:100 µl 2:500 µl 3:1000 µl 4:2500 µl
5:5000 µl

16th parameter : Needle down speed (1 or 2)

Notes:

1. Transmit an @ mark within 60 seconds after receiving data. If the autosampler does not receive an @ mark within 60 seconds after sending the data, it displays "ERROR to RS-232C TIME OUT!" in the LCD and cancels the remote mode.
2. If a "?" mark is sent instead of an @ mark, the same data is sent again.

PARAMWRITE:

Transfers 16 different control parameters from an external computer to the parameter file of the autosampler.

Table 3-10 shows signal transfers between an external computer and an autosampler with the PARAMWRITE command.

Table 3-10

External Computer	Signal Direction	Autosampler
PARAMREAD [terminator]	→	
	←	@ [terminator]
	→	1st parameter [terminator]
@ [terminator]	←	
	→	
	←	2nd parameter [terminator]
	→	
@ [terminator]		
	→	16th parameter [terminator]
@ [terminator]	←	
	→	

where:

1st parameter : Standard calibration to be performed (0: not measured, 1: measured)

2nd parameter : Number of unknown samples to be measured between standards (1 to 250)

3rd parameter : Employed rack code (1 to 16)

4th parameter : Syringe speed (1 to 5)

5th parameter : Injection method (1: CUT injection, 2: ALL volume injection, 3: Full Loop injection)

6th parameter : LEAD VOLUME (0 to 1000.0 μl)

7th parameter : REAR VOLUME (0 to 1000.0 μl)

8th parameter : FEED VOLUME (0 to 1000.0 μl)

9th parameter : WASTE VOLUME (0 to 4000.0 μl)

10th parameter : Number of times for needle washing (1 to 20.0)

11th parameter : NEEDLE WASH SPEED (1 to 5)

12th parameter : Number of injection port washings (0 to 20.0)

13th parameter : INJECTION PORT WASH SPEED (1 to 5)

14th parameter : PUMP PLUNGER WASH (0: NO, 1: YES)

15th parameter : Syringe volume (1 to 5)
1:100 µl 2:500 µl 3:1000 µl 4:2500 µl
5:5000 µl

16th parameter : Needle down speed (1 or 2)

Notes:

1. Transmit the data in the order shown in Table 3-10.
2. Transmit data within 60 seconds after receiving an @ mark. If the autosampler receives no data within 60 seconds, it displays "ERROR to RS-232C TIME OUT!" in the LCD and cancels the remote mode.

FILEREAD:

Transfers a program from the sequential program file to an external computer. Every step covers 5 data points.

Table 3-11 shows the signal transfer between an external computer and an autosampler with the FILEREAD command.

Table 3-11

External Computer	Signal Direction	Autosampler
FILEREAD [terminator]	→	
	←	@ [terminator]
	←	STD 1st parameter [terminator]
@ [terminator]	→	
	←	
	→	STD 2nd parameter [terminator]
@ [terminator]	→	
	←	STD 5th parameter [terminator]
@ [terminator]	→	
	←	UNKNOWN 1st step 1st parameter [terminator]
@ [terminator]	→	
	←	UNKNOWN 1st step 5th parameter [terminator]
@ [terminator]	→	
	←	UNKNOWN last step 1st parameter [terminator]
@ [terminator]	→	
	←	UNKNOWN last step 2nd parameter [terminator]
@ [terminator]	→	
	←	UNKNOWN last step 5th parameter [terminator]
@ [terminator]	→	
	←	END [terminator]
@ [terminator]	→	

where,

(one set of parameters for standards)

STD 1st parameter : Number of levels for the standard sample (1 to 8)

STD 2nd parameter : Start vial No. of the standard sample (1 to 190)

STD 3rd parameter : Aspiration volume of the standard sample (0 to 4000.0 μl)

STD 4th parameter : Number of measurements per vial of the standard sample (1 to 99)

STD 5th parameter : Stop time of the standard sample measurement (0 to 999.9 min)

(one set of parameters for the end series of the unknowns)

UNKNOWN ith step
1st parameter : Start vial No. of the unknown sample (1 to 250)

UNKNOWN ith step
2nd parameter : End bottle No. of the unknown sample (1 to 250)

UNKNOWN ith step
3rd parameter : Aspiration volume of the unknown sample (0 to 4000.0 μl)

UNKNOWN ith step
4th parameter : Number of measurements per vial of the unknown sample (1 to 99)

UNKNOWN ith step
5th parameter : Stop time of the unknown sample (0 to 999.9 min)

Notes:

1. Every step consists of 5 data points. Namely, if every program has 10 steps (including 1 step for standard sample measurement), $10 \times 5 = 50$ data points are sent from the autosampler. After transmission of the final step of a program, an END statement is sent from the autosampler.
   This END indicates the end of a program transfer and is not part of a program.
2. Transmit an @ mark within 60 seconds after receiving data.
   If the autosampler does not receive an @ mark within 60 seconds after transmitting the data, it displays "ERROR to RS-232C TIME OUT!" in the LCD and cancels the remote mode.

FILEWRITE:

Transfers a program (5 data/step) from an external computer to a sequential autosampler program file.

Table 3-12 shows signal transfers between an external computer and an autosampler with the FILEWRITE command.

Table 3-12

External Computer	Signal Direction	Autosampler
FILEWRITE [terminator]	→	
	←	@ [terminator]
STD 1st parameter [terminator]	←	
	→	@ [terminator]
STD 2nd parameter [terminator]	→	
⋮	⋮	⋮
	→	@ [terminator]
STD 5th parameter [terminator]	→	
	←	@ [terminator]
UNKNOWN 1st step 1st parameter [terminator]	→	
⋮	⋮	⋮
	←	@ [terminator]
UNKNOWN 1st step 5th parameter [terminator]	→	
⋮	⋮	⋮
	←	@ [terminator]
UNKNOWN last step 1st parameter [terminator]	→	
⋮	⋮	⋮
	←	@ [terminator]
UNKNOWN last step 5th parameter [terminator]	→	
	←	@ [terminator]
END [terminator]	→	
	←	@ [terminator]

where,

(1 step for the standard sample measurement)

STD 1st parameter : Number of levels for the standard sample (1 to 8)

STD 2nd parameter : Start vial No. of the standard sample (1 to 190)

STD 3rd parameter : Aspiration volume of the standard sample (0 to 4000.0 μl)

STD 4th parameter : Number of measurements per vial of the standard sample (1 to 99)

STD 5th parameter : Stop time of the standard sample measurement (0 to 999.9 min)

(1 step for unknown sample measurement)

UNKNOWN ith step

1st parameter : Start vial No. of the unknown sample (1 to 200)

UNKNOWN ith step

2nd parameter : End vial No. of the unknown sample (1 to 200)

UNKNOWN ith step

3rd parameter : Aspiration volume of the unknown sample (0 to 4000.0 μl)

UNKNOWN ith step

4th parameter : Number of measurement per vial of the unknown sample (1 to 99)

UNKNOWN ith step

5th parameter : Stop time of an unknown sample (0 to 999.9 min)

Notes:

1. Transmit data to the autosampler in the order shown in Table 3-12.
   After transmitting the last step 5th parameter of a program, send an END statement as soon as an @ mark is received.
2. Transmit data within 60 seconds after receiving an @ mark. If the autosampler does not receive data within 60 seconds, it displays "ERROR to RS-232C TIME OUT!" in the LCD and cancels the remote mode.
3. If an error occurs during data transmission, the steps before the error are set in the sequential program file.

3.4 Typical Use of a Communication Program

Figure 3-8 shows a program for reading and displaying in an external computer the program to control an autosampler.

```
10      ******* TEST ********
20      DIM ST$ (1000)
100     OPEN "COM1: E73NN" AS#1
200     S$="REMOTE 1"      : GOSUB 1000 ... REMOTE command transmission
210     S$="PROGREAD "     : GOSUB 1000.....PROGREAD command transmission
220     S$="@"             : GOSUB 1100 ... Comment reception and display
230     FOR I=1 TO 20                    ┐
240     S$="@"             : GOSUB 1100  } ... Variables (I1 to I20) reception and
250     NEXT I                           ┘   display

270     S$="@"             : GOSUB 1100  ┐
280     ST$(I)=A$                        } ... Program reception
290     IF A$< > "END" THEN GOTO 270     ┘
300     S$="LOCAL"         : GOSUB 1000 ... LOCAL command transmission
400     END
1000    **** TX. (1) *****
1010    PRINT #1, S$
1020    LINE INPUT #1, A$
1030    PRINT S$, A$
1040    RETURN
1100    **** TX. (2) *****
1110    LINE INPUT #1, A$
1120    PRINT #1, S$
1130    PRINT S$, A$
1140    RETURN
```

Figure 3-8 Typical Program Using Communication Commands (created through NEC N88-BASIC)

3.5 Precautions When Using RS-232C

1. When Turning On the Power Supply

You must turn off the computer power supply to completely reset all internal circuits. When you turn the computer power supply back on, sometimes an extraneous signal is sent to the RS-232C circuit just after turning it on. This signal can produce erroneous characters, such as an "X", in the autosampler's buffer memory. When an external computer then sends a correct command into the autosampler's buffer memory, the unit not only writes the "REMOTE" command but the "X" and the command becomes "XREMOTE". When the autosampler tries to read "XREMOTE", it generates an error. To correct this situation, you should write programs that direct the computer to send the same command again when this occurs.

The external computer also has a buffer memory for RS-232C. Sometimes after turning-on the autosampler power supply, extraneous data is sent from the autosampler to the computer. Each computer reacts differently when it receives this erroneous data. Some computers may display a data overflow error and stop their operation. Figure 3-9 shows a program written in Microsoft GW-Basic to correct a data overflow error occurring in a Hewlett-Packard Vectra computer. Observe the following commands in that program.

1a. You can trap "DEVICE I/O ERROR" with an "ON ERROR GOTO" command. Use the commands at line 5, 200, 210 to transfer program execution to line 40.

1b. Line 35 is a countermeasure against the erroneous data coming from the personal computer.

1c. Line 145 sends an "@" mark to protect the computer if it receives the LOCAL command of line 140. Otherwise, an "@" mark is left in the computer's buffer memory and a "Time out error" occurs.

```
5 ON ERROR GOTO 200
10 OPEN "COM1:4800,E,7,2" AS #2
20 PRINT #2,"REMOTE 1"
30 LINE INPUT #2,D$:GOSUB 170
35 IF D$ <> "@" THEN GOTO 20
40 PRINT #2,"HOME"
50 LINE INPUT #2,D$:GOSUB 170
60 PRINT #2,"DISP 1 100 5"
70 LINE INPUT #2,D$:GOSUB 170
80 PRINT #2,"TUBE 0 0"
90 LINE INPUT #2,D$:GOSUB 170
100 PRINT #2,"TUBE 0 1"
110 LINE INPUT #2,D$:GOSUB 170
120 PRINT #2,"HOME"
130 LINE INPUT #2,D$:GOSUB 170
140 PRINT #2,"LOCAL"
145 LINE INPUT #2,D$:GOSUB 170
150 CLOSE #2
160 END
170 PRINT D$:RETURN
200 IF ERR = 57 THEN GOTO 40
210 PRINT "error code:" ERR ERL:GOTO 140
```

Figure 3-9 Example of a Microsoft GW-Basic Program

4 OPTIONAL ACCESSORIES

4.1 Principle and Functions

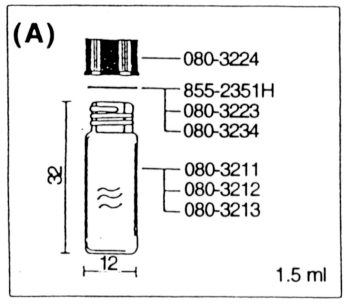
The design of the L-7250 Autosampler allows you to select different size sample and reagent vials, racks, syringes, etc. These accessories enhance the capabilities of your autosampler and serve the special needs of many analyses.

Use these optional accessories while operating the L-7250 Autosampler in the programming mode. For example, you may want to use a large vial holding rack and a large sampling syringe when creating a program to derivatize a sample prior to its injection.

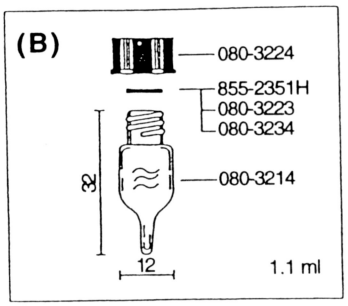
4.2 Vials

Table 4-1 shows the different types of sample and reagent vials you can use with the L-7250 Autosampler. Combine them according to the needs of your application.

Table 4-1(a) Screw-top Vials

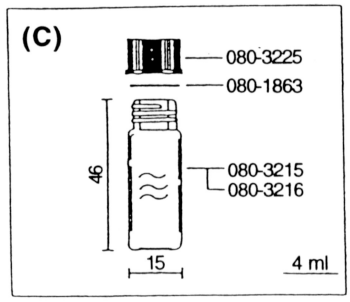


Part No.	Name	Specification/ Standard	Applicable Rack	Remarks
080-3211	1.5 ml sample vial, contains 250 pcs	Type of vial: 2-SV, 12 ϕ × 32 mm	810-3504 810-3539	With blue mark
080-3212	1.5 ml sample vial, contains 250 pcs	Type of vial: 2-SV(G), 12 ϕ × 32 mm, low-alkaline glass		With yellow mark
080-3213	1.5 ml sample vial (brown), contains 250 pcs	Type of vial: 2-SV(A), 12 ϕ × 32 mm		
855-2351H	Septum (Si-TEF), contains 100 pcs	With slit (-)		
080-3223	Septum (PTFE-Si-PTFE), contains 250 pcs	Without slit		
080-3234	Septum (Si-PTFE), contains 250 pcs	Without slit		
080-3224	Screw cap (black), contains 250 pcs	Type of cap: 8-SC		

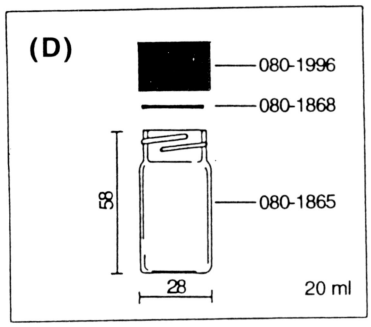


Part No.	Name	Specification/ Standard	Applicable Rack	Remarks
080-3214	1.1 ml sample vial, contains 250 pcs	Type of vial: 1.1-STVG, 12 ϕ × 32 mm, pointed-bottom type	*810-3504 *810-3539	
855-2351H	Septum (Si-TEF), contains 100 pcs	With slit (-)		
080-3223	Septum (PTFE-Si-PTFE), contains 250 pcs	Without slit		
080-3234	Septum (Si-PTFE), contains 250 pcs	Without slit		
080-3224	Screw cap (black), contains 250 pcs	Type of cap: 8-SC		
080-3230	Support sleeve, contains 50 pcs	Type: TTS-312, Teflon		

* Requires the support sleeve for use on the standard rack (810-3021).

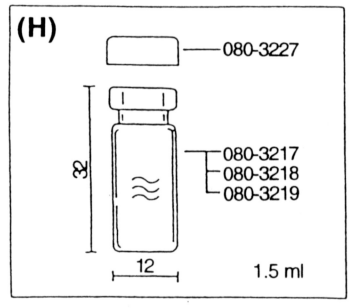


Part No.	Name	Specification/ Standard	Applicable Rack	Remarks
080-3215	4 ml sample vial, contains 250 pcs	Type of vial: 4-SV, 15 $\phi \times 46$ mm	810-3504 810-3540	
080-3216	4 ml sample vial (brown), contains 250 pcs	Type of vial: 4-SV(A), 15 $\phi \times 46$ mm		
080-1863	Septum (Si-PTFE), contains 100 pcs	With slit (+)		
080-3225	Screw cap (black), contains 250 pcs	Type of cap: 12-SC		

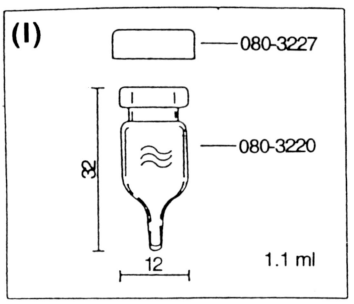


Part No.	Name	Specification/ Standard	Applicable Rack	Remarks
080-1865	20 ml reagent vial, contains 72 pcs	28 $\phi \times$ 58 mm	810-3541	
080-1868	Septum (Si-TEF), contains 100 pcs	With slit (+)		
080-1996	Screw cap, contains 200 pcs			

Table 4-1(b) Crimp-top Vials



Part No.	Name	Specification/ Standard	Applicable Rack	Remarks
080-3217	1.5 ml crimp-top sample vial, contains 250 pcs	Type of vial: 2-CV, 12 $\phi \times 32$ mm	810-3504 810-3539	With blue mark
080-3218	1.5 ml crimp-top sample vial, contains 250 pcs	Type of vial: 2-CV(G), 12 $\phi \times 32$ mm, low-alkaline glass		With yellow mark
080-3219	1.5 ml crimp-top sample vial (brown), contains 250 pcs	Type of vial: 2-CV(A), 12 $\phi \times 32$ mm		
080-3227	Crimp cap (with septum), contains 250 pcs	Type of cap: 11-AC-TST1, with PTFE-Si-PTFE (three-layer) septum		Without slit on septum



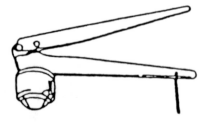
Part No.	Name	Specification/ Standard	Applicable Rack	Remarks
080-3220	1.1 ml crimp-top sample vial, contains 250 pcs	Type of vial: 1.1-CTVG, 12 $\phi \times 32$, pointed-bottom type	*810-3504 *810-3539	
080-3227	Crimp cap (with septum), contains 250 pcs	Type of cap: 11-AC-TST1, with PTFE-Si-PTFE (three-layer) septum		Without slit on septum
080-3230	Support sleeve, contains 50 pcs	Type: TTS-312, Teflon		

* Requires the support sleeve when you use this vial.

Crimp-top Vials

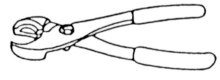
Place the septum in the aluminum crimp cap. Seal the cap in the vial using the crimper tool.
To remove the cap, use the decapper.

Crimper



Part No.	Name	Remarks
080-3232	Crimper CR-8	For sealing of 080-3226
080-3233	Crimper CR-11	For sealing of 080-3227

Decapper



Part No.	Name	Remarks
080-3258	Decapper DCR-8	For removal of 080-3226
080-3259	Decapper DCR-11	For removal of 080-3227

4.3 Rack

The model L-7250 autosampler has various optional racks for sample preparation in addition to the standard 120 position rack. Use them to satisfy the needs of your application.

4.3.1 Standard Accessory Rack

Model L-7250 comes with a 120 position rack accessory. Figure 4-1 shows the outer appearance of the standard rack. This rack is used mainly when you want to inject the samples in sequence (sequential mode).

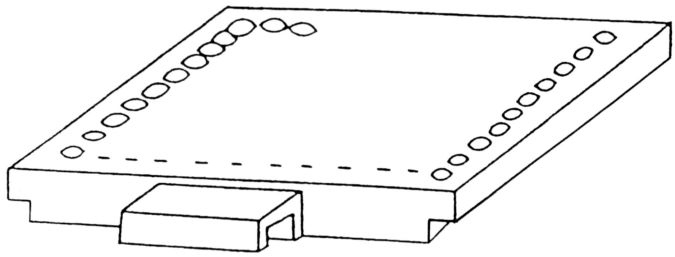


Figure 4-1 Outer Appearance of the Standard 120 Position Rack for the 1.5 ml Vials (P/N 810-3504)

4.3.2 Sample Preparation Rack

For sample preparation, you need a reagent and a reaction vial in addition to the sample vial.

Figure 4-2 shows the rack positions and how to install the sample preparation rack on the rack holder. Figure 4-3 shows the outer appearance of the sample preparation racks of the L-7250 Autosampler. When you use the racks shown in Figure 4-2, you need the rack holder (P/N 810-3538).

Figure 4-2 shows that you can mount a maximum of three racks on the rack holder (P/N 810-3538).

Each of the racks has a specific length. Align and set the rack's reference pin with the reference hole of the rack holder.

Upon setting the rack on the rack holder, make sure that the rack aligns properly with the L-7250 rack holder.

Important:	Make sure that the rack reference pin seats completely in the rack holder reference hole and that the rack is properly aligned.

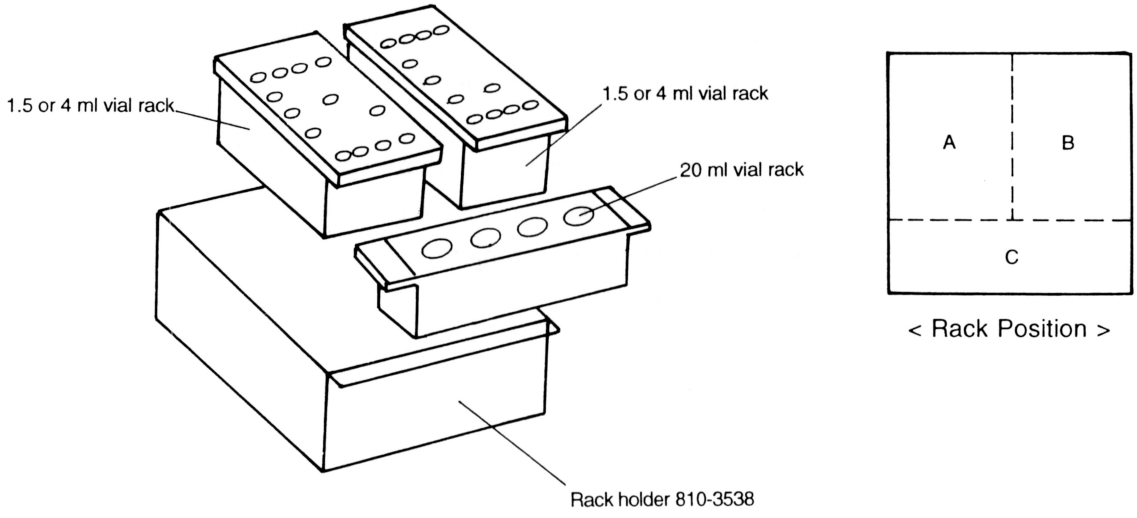


Figure 4-2 Installing the Sample Preparation Rack

Outline of rack	Outer appearance view		
No. of vials	32 pcs	21 pcs	4 pcs
Part No. of rack	810-3539 (For vials of 1.5 ml)	810-3540 (For vials of 4 ml)	810-3541 (For vials of 20 ml)

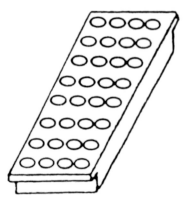
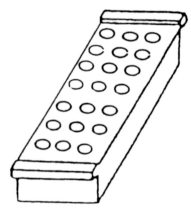
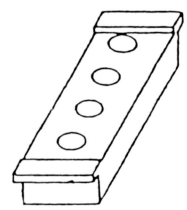
Figure 4-3 Outer Appearance of the Sample Preparation Racks

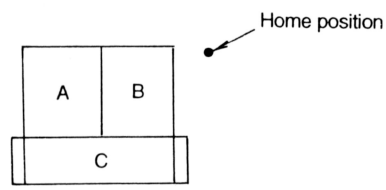
When using these racks, enter the rack parameter that matches the kind and position of the rack.

Table 4-1 lists the rack parameters. Before using a rack, press the UTILITY key and set the rack parameter and the rack code for the rack you are using. You must use the values in this table (Table 4-1) to obtain the needle height (in the Z direction) for the vial you are using.

Note: You can only use one type of rack in the sequential mode. It is not possible to arrange more than 2 sample preparation racks in the sequential mode and perform a sequential analysis between the racks. Use the sample preparation racks shown in Table 4-1 only in the programming mode.

Table 4-1 Rack Parameters

Rack		810-3539 (1.5 ml vial)		810-3540 (4 ml vial)		810-3541 (20 ml vial)
		Rack Position		Rack Position		Rack Position
Parameter		A	B	A	B	C
X_1		93.5	25.5	99	31	37
Y_1		2	2	3	3	142
X_2		144.5	76.5	139	71	133
Y_2		107	107	105	105	142
Z		36	36	48	48	57
N_X		4	4	3	3	4
N_Y		8	8	7	7	1
P		1	1	1	1	1
Outline of the rack	Appearance					
	No. of vials	32		21		4
Remarks						Align the longitudinal side of this rack in the left-right direction.



< Rack Position >

4.4 Syringes

4.4.1 Syringe Types

You can select one from five different syringes to use with the L-7250 Autosampler (see Table 4-2). Each syringe has a different capacity. This table also shows the sample coil capacity, the correct sample coil connecting tube dimensions for each syringe, and the part number.

Table 4-2 Syringe Types

Syringe Capacity	Combined Syringe Part No.	Single Syringe Part No	Sample Coil Connecting Tube			Remarks
			Capacity	Tube Dimensions	Part No.	
0.1 ml	810-3313	080-1591	0.16 ml	0.5 mm ID × 1.6 mm O D × 0.8 m	810-3360	
0.5 ml	810-3314	080-1064	0.79 ml	1 mm ID × 2 mm OD × 1.0 m	810-3504	Standard furnished with L-7250
1.0 ml	810-3315	080-1592	1.57 ml	1 mm ID × 2 mm OD × 2.0 m	810-3362	
2.5 ml	810-3316	080-1092	3.92 ml	1 mm ID × 2 mm OD × 5.0 m	810-3363	
5 ml	810-3317	080-1593	7.85 ml	1 mm ID × 2 mm OD × 10.0 m	810-3364	

Note: The combined syringe part number is for the syringe and its corresponding sample coil connecting tube.

4.4.2 Precautions When Using the Optional Syringe

- **Syringe Speed and Pressure Resistance**

Table 4-3 shows the relationship between the syringe speed and the flow rate. When the syringe inner pressure exceeds the syringe pressure resistance, it creates an "unusable" area in the table.

Table 4-3 Syringe Speed and Flow Rate

Syringe Capacity	Flow Rate (μl/s)				
	0.1 ml	0.5 ml	1.0 ml	2.5 ml	5 ml
Syringe speed 1	1	5	10	25	50
Syringe speed 2	2	10	20	50	100
Syringe speed 3	7.5	37.5	75	187.5	Unusable
Syringe speed 4	15	75	150	Unusable	Unusable
Syringe speed 5	30	150	300	Unusable	Unusable

4.4.3 Syringe Replacing Procedure

Use the following procedure to replace the syringe.

1. How to Remove Syringe

1a. Turn off the autosampler power switch.

1b. Remove the right side lid which is secured with a magnetic latch.

1c Use your hand to push the syringe hook down about 1 cm.

1d. Use your hand to turn the metallic section on the top of syringe counterclockwise. This section comes off the dilutor valve. Pull it straight out through the side.

2. How to Remove the Sample Coil Connecting Tube

2a. Remove the M6 setscrew from the top of the dilutor valve by turning the screw counterclockwise by hand.

2b. Loosen the setscrew from the needle section by turning it counterclockwise by hand.

2c. Carefully take out the sample coil connecting tube.

3. How to Mount a Syringe

3a. Before mounting a new syringe, fill it with distilled water or the same liquid you will use for washing.

⚠ CAUTION
Whenever possible avoid moving the plunger when the syringe interior is dry. If the syringe is dry, its poor lubrication hinders normal movement and causes excessive wear of the plunger seal.

3b. To install a syringe, reverse the removal procedure given earlier.

4. How to install the sample coil connecting tube

4a. Use the connectors to attach the sample coil connecting tube.

4b. Connect the ends of the connecting tube to the needle and the dilutor valve. Connect the setscrew to the needle and the M6 setscrew to the dilutor valve.

4c. Make sure that the tube that connects to the needle does not block or pull when the needle moves.

5. How to Purge the Flow Path

After replacing the syringe, fill the syringe and sample coil connecting tube with the washing liquid. Do this through the following operation:

5a. Press **WASH** to purge.

Use the following method if the syringe capacity is 0.1, 0.5 or 1 ml.

(1) Select the washing liquid.
(2) Turn on the power switch.
(3) Press **WASH**.

Repeat this operation about 3 times. This will fill the syringe and the sample coil connecting tube with the washing liquid.

5b. For Washing in the Programming Mode

When the syringe capacity is 2.5 or 5 ml, you can not use the **WASH** key, you need to write a program. Use the following procedure:

(1) Select the washing liquid.
(2) Turn on the power switch.
(3) Press the **MODE** key to select the programming mode.
(4) Press the **EDIT** key.

(5) Create the following program:

1	DO	3	1	1	1
2	TUBE	0	0		
3	DISP	1	*2500	2	
4	TUBE	0	1		
5	DISP	1	*2500	2	
6	HOME				
7	LOOP				

* Key in 5000 instead of 2500 in steps 3 and 5 when using the 5 ml syringe.

(6) Press **START**.

When you start this program, the DO loop causes a purge of the flow path to occur three times.

Important: Before using the system, be sure that there are no leaks at the connections between the syringe and valve, the dilutor and sample coil, and the sample coil and needle.

6. When installing a large syringe assy, please change following settings at L-7250 under UTILITY (and D-7000 HSM if existing). This is an example for a 5 mL syringe.

6a. Syringe Code has to be changed to 5.
UTILITY > 4) OPTION > 1) SYR VOL > SYRINGE VOL. CODE: 5

6b. Syringe Speed for sample site has to be changed to 1 or 2.
UTILITY > 1) SEQ > 2) OPERATION PARAM > SYR SPEED > SYRINGE SPEED: 1 or 2

6c. Syringe Speed for washing liquid has to be changed to 1 or 2.
UTILITY > 3) APL PARAM > 1) WASH > NEEDLE WASH STROKES > NEEDLE WASH SPEED: 1 or 2 > INJ.PORT WASH STROKES > NEEDLE WASH SPEED: 1 or 2

4.5 Sample Loops

4.5.1 Tubing

Table 4-4 shows the various sample loops you can use with the autosampler. Figure 4-4 shows how to connect the loop to the valve.

Table 4-4 Sample Loops

Part No.	Name	Remarks
080-3200	Sample loop 10 µl	
080-3201	Sample loop 20 µl	
080-3202	Sample loop 50 µl	
080-3203	Sample loop 100 µl	Furnished as standard
080-3204	Sample loop 200 µl	
080-3205	Sample loop 500 µl	
080-3206	Sample loop 1 ml	
080-3207	Sample loop 2 ml	

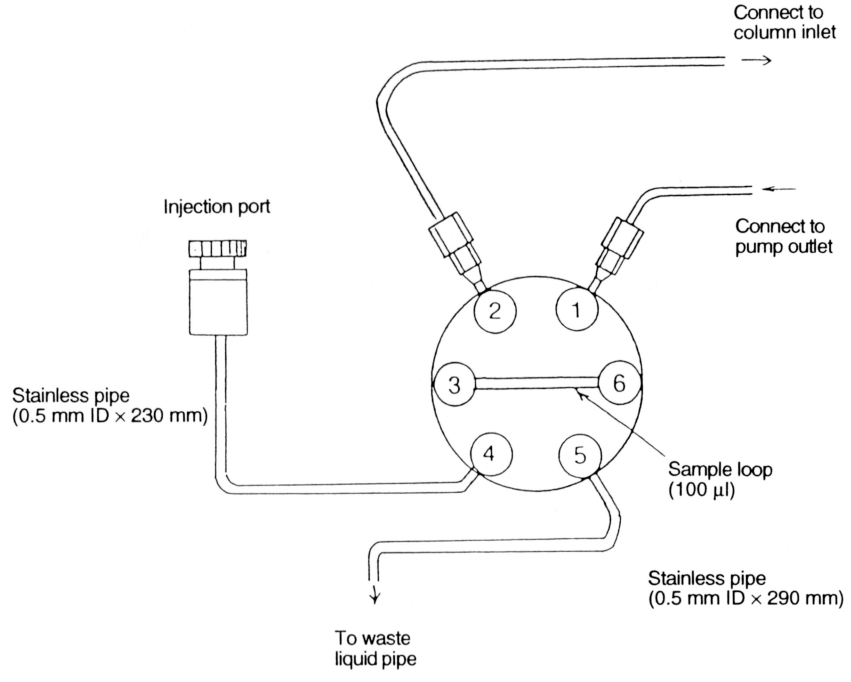


Figure 4-4 Installation of the Sample Loop

4.5.2 Sample Volume Measurement

When you use the autosampler, the size of the sample that is withdrawn from the vial and the loop size are closely related. First, you must consider the volume of the sample that is available. Second, you must consider the acceptability of sample dilution (because when you dilute the sample, the minimum detectable level is adversely affected). Third, you must consider the loop size you are using.

Examine the following two extreme situations:

- You have a large amount of sample and want to avoid sample dilution. Determine what sample amount to withdraw from the vial to ensure minimum dilution.
- You have a very small sample and want to maximize the amount of sample that is injected into the column. You must now determine what minimum sample amount to withdraw from the vial to obtain an acceptable analysis.

There are two general approaches to the issue of sample size:

- Use the Syringe Measuring Method when you have a limited amount of sample and you want to inject a maximum amount of sample in the column. In this approach, the amount of sample that you place in the loop is smaller than the size of the loop (for example, you only have 100 µl of sample and the loop has a capacity of 500 µl). For details, see Section 4.5.3.
- Use the Loop Measuring Method when you have a large amount of sample and you do not want to dilute the sample. If you withdraw 5 loop volumes from the vial and pass the entire volume through the loop, sample dilution in the loop is less than 1%. For details, see Section 4.5.4.

Measuring Method	Procedure	Description
Syringe Measuring Method	Dispensing volume from the syringe	Measurement is guaranteed when the sample taken is less than half of the loop capacity. (See Figure 4-5)
Loop measuring method	Sum of the flow path capacity of the sample loop and injector	To fill the loop with 99% of concentrated sample, the sample volume should be about 5 times the loop capacity. (See Figure 4-6.)

4.5.3 Syringe Measuring Method

See Figure 4-5 to select the sample injection volume when using the Syringe Measuring Method. The acceptable range is in gray (i.e. the sample injection volume must be less than 50% of the loop volume). As an example, to maximize the accuracy of the analysis when you use a 200 µl loop, do not inject more than 100 µl.

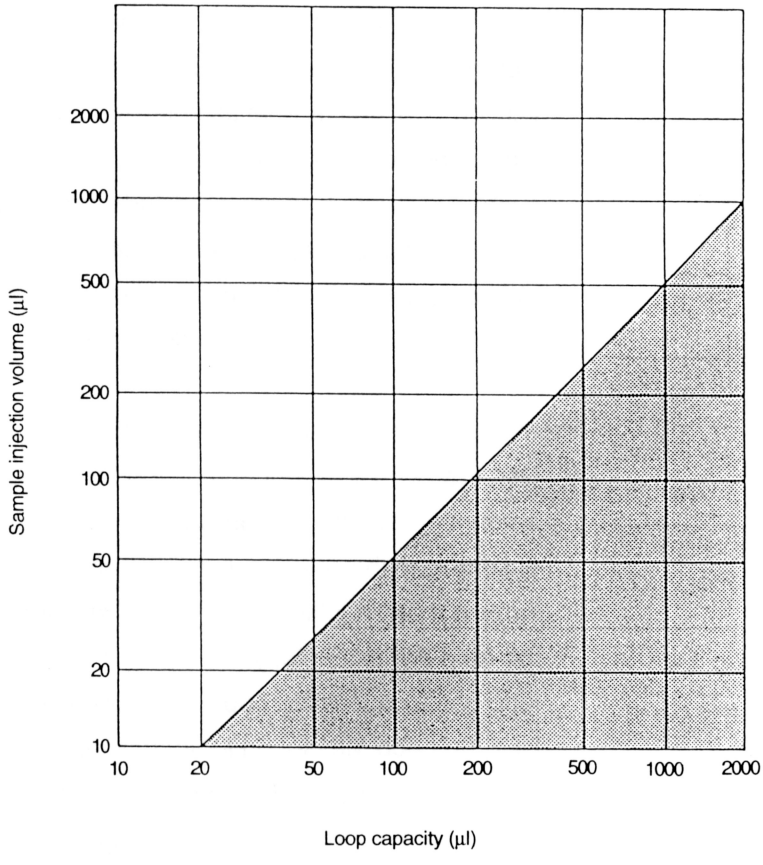


Figure 4-5 Syringe Measuring Method

Note:	Observe Figure 4-5. You can inject any sample volume that is in the hatched range.
	(**Example:** When you want to measure a 100 µl sample, you will need at least a 200 µl sample loop. That is, the loop size should be at least double the sample size you want to measure.)

4.5.4 Loop Measuring Method

See Figure 4-6 to select the correct sample volume when using the Loop Measuring Method. The acceptable range is shown in gray (i.e. you must inject a sample volume that is at least 5 times the loop volume.) For example, if you are using a 200 µl loop, withdraw 1000 µl to maximize the accuracy of the analysis.

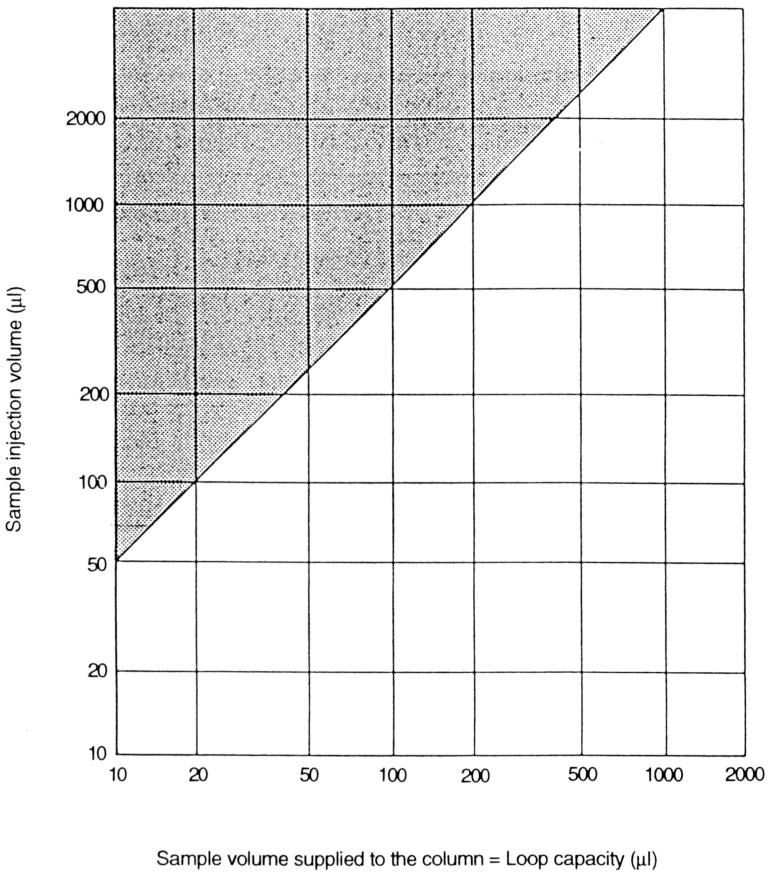


Figure 4-6 Loop Measuring Method

> **Note:** To fill the loop with a 99% concentrated sample, the sample injection volume must fall in the hatched range.
> (**Example:** When you need to measure 100 µl of sample, inject 500 µl or more of sample. That is, you need 5 times the loop capacity.)

4.6 Pump Plunger Washing

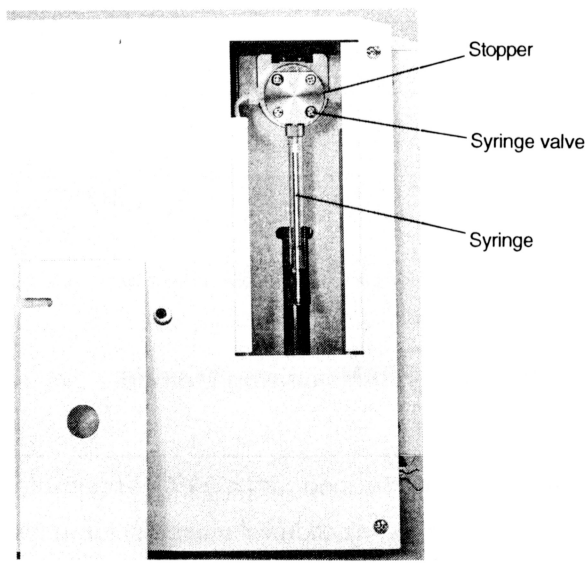
You can use the L-7250 pump plunger seal cleaning function to automatically perform this task. See Section 1.8 in this manual and Section 2.3.2.2c of the BASIC OPERATION manual for instructions. The Pump Seal Washing System Instruction Manual gives details on the tubing connections.

1. Detach the stopper of the syringe valve on the L-7250 autosampler and connect the tube (4) of the pump seal washing system. This tube comes with the pump seal washing system.

2. Connect the jumper tube (1) with tube (4). Run tube (4) through the duct of each unit.

3. Place the drain tube into the drain bottle. Secure the drain tube to the pump side with a clamp so that its end does not bend.

4. Perform a washing operation according to the instructions given in Section 1.8 of this instruction manual.



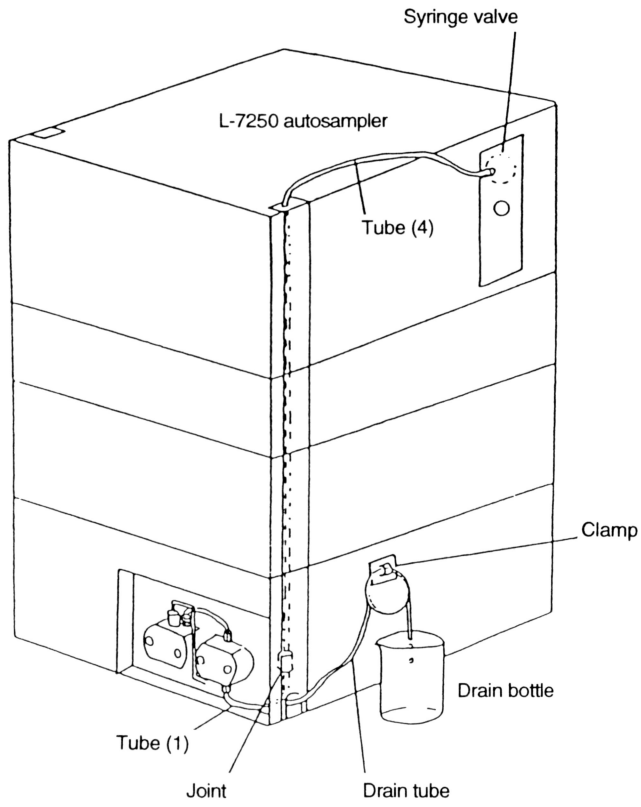


Figure 4-7 Pump Plunger Washing

⚠ CAUTION
The autosampler uses 1.0 ml of the washing solution on each washing. Since the washing occurs at the end of each analysis, make sure that you have enough wash solution and that the waste bottle is large enough to hold the wash solution waste.

4.7 Measurement Examples

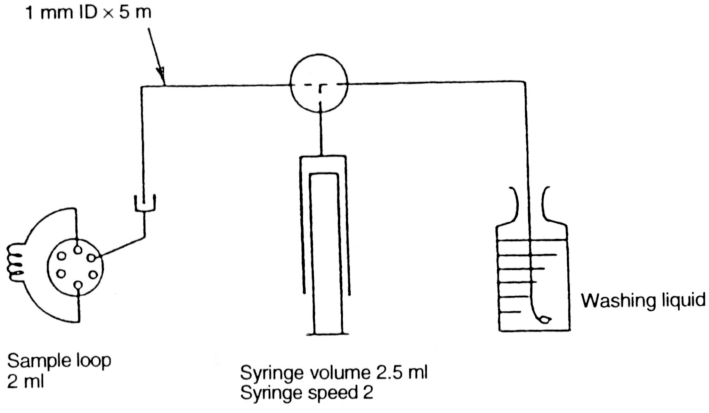
This section shows an example of a program that uses the optional syringe and an optional rack.

4.7.1 Program for Injecting 1 ml of Sample

On the L-7250, you can create a program that injects a large sample volume and uses an optional large syringe and a large capacity sample loop. Our example will show a 1 ml sample injection that uses a 2.5 ml syringe and a 2 ml sample loop.

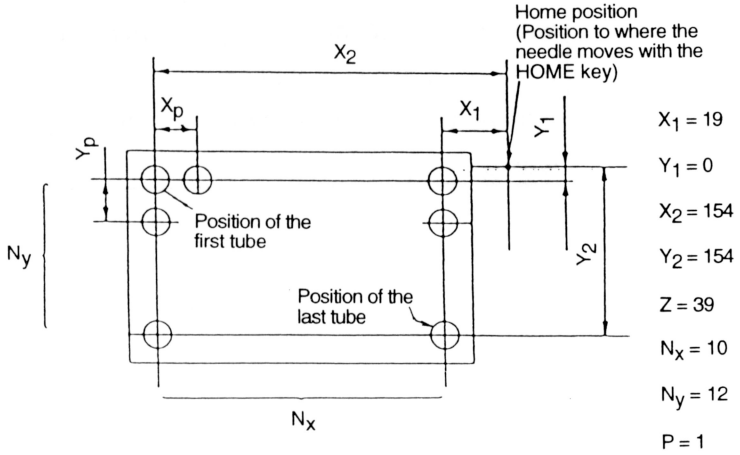
In this example, you will inject 1 ml of sample into the column and repeat the process in sequence 120 times.

1. Sampler Conditions



2. Sampler Rack Condition

Standard rack (1.5 ml 15 × 10 pcs used) (RACK CODE = 1)



3. Injecting Conditions

Injection volume : 1 ml

Cut volume : V = 30 µl, Vr = 30 µl

Number of washings : 1 per port

4. Example of Program to Inject 1 ml of Sample

Line No.	Command	Parameter				Description
1	DO	120	1	1	1	Command for repeating process 120 times I1 ← 1
2	WAIT SIGNAL	3	1			Detects BUSY signal
3	TUBE	0	0			Washes inner and outer walls of needle
4	DISP	1	2500	2		
5	SVALVE	1	0			Aspirates washing liquid from washing liquid bottle (dead volume)
6	SYRINGE	1	55.0	2		
7	HEIGHT	0	2			Aspirates air
8	ASP	1	5	2		
9	TUBE	1	I1			Aspirates sample 30 µl(Vl) + 1000 µl(INJ) + 30 µl(Vr)
10	ASP	1	1060	2		
11	WAIT	1				
12	HEIGHT	0	2			Aspirates air
13	ASP	1	5	2		
14	TUBE	0	0			Washes outer wall of needle
15	TUBE	0	1			Dispenses the cut volume Vl 30 µl(Vl) + 5 µl(AIR) + 55.0 µl(dead volume)
16	DISP	1	90.0	2		
17	WAIT	1				
18	VALVE	1				Switches INJ. valve
19	WAIT	1				
20	DISP	1	1000	2		Dispenses 1000 µl (injection volume)
21	WAIT	1				
22	VALVE	0				Switches INJ. valve
23	OUT	1	1			EXT START signal ON (1 second)
24	TIMER	60				Sets a stop time of 60 seconds.
25	WAIT	1				
26	OUT	1	0			
27	DISP	1	2500	2		Washes injection port
28	TUBE	0	0			Washes inner and outer needle walls
29	DISP	1	2500	2		
30	HOME					Returns to the home position.
31	WAIT TIMER					Waits for the STOP time
32	LOOP					Returns to DO.

Note: If you want to change the injection volume in this program, rewrite lines No. 10 and 20. Change the aspiration volume on line No. 10 to (injection volume + Vl + Vr), and the dispensing volume on line No. 20 to the injection volume.
You can not aspirate (ASP) a volume that is greater than the capacity of the syringe you are using.

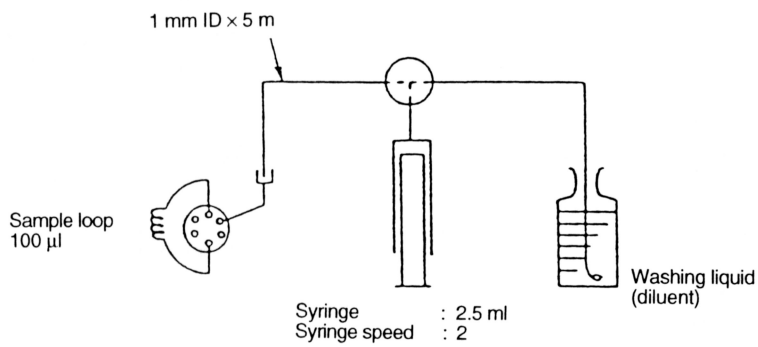
4.7.2 Dilution Program

1. When the washing liquid and the diluent are the same:
In this program, dilute the sample 10 times and then inject it. In the example, the diluent is the same as the washing liquid. Aspirate the diluent (washing liquid) from the washing liquid bottle.

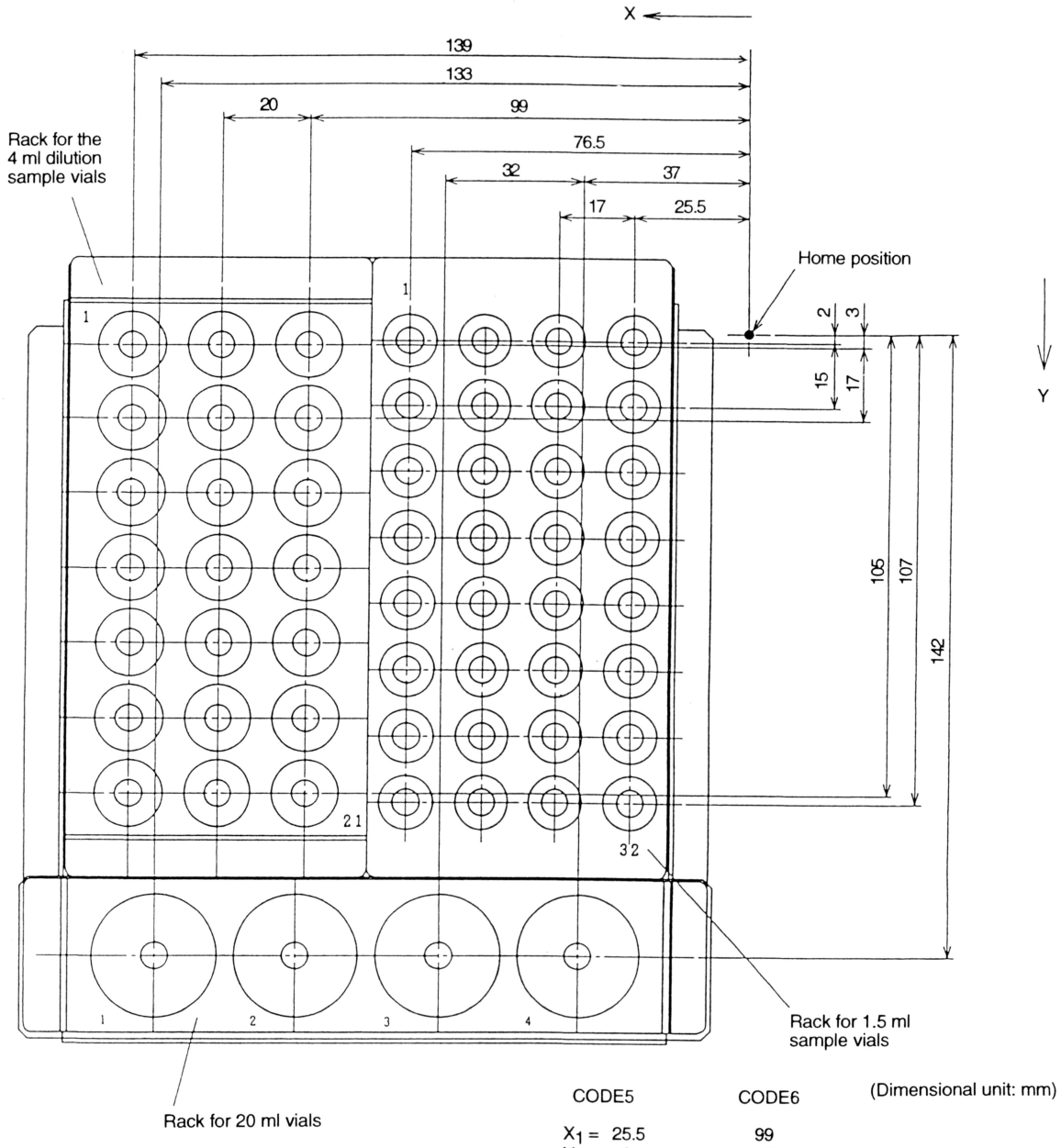
1a. Diluting Conditions

- Diluent: Uses the washing liquid (when the diluent is the same as the washing liquid).
- Sample: 300 µl
- Diluent: 2700 µl
- Total: 3000 µl
- Stir 10 times

1b. Autosampler Conditions



1c. Sample Rack Conditions



(Dimensional unit: mm)

	CODE5	CODE6
X_1 =	25.5	99
Y_1 =	2	3
X_2 =	76.5	139
Y_2 =	107	105
Z =	36	48
N_x =	4	3
N_y =	8	7
P =	1	1

1d. Injecting Conditions

Injection volume : 50 µl

Cut volume : V = 30 µl, Vr = 30 µl

Number of washings : 1 per port

1e. Program

Line No.	Command	Parameter				Description
1	DO	21	1	1	1	Command to repeat (STEP UP)
2	WAIT SIGNAL	3	1			Detects BUSY signal
3	TUBE	0	0			Washes inner and outer needle walls
4	DISP	1	2500	2		
5	SVALVE	1	0			Aspirates washing liquid from the washing liquid bottle
6	SYRINGE	1	1300	2		
7	WAIT	5				
8	HEIGHT	0	2			Aspirates air
9	ASP	1	5	2		
10	TUBE	5	1			Aspirates sample (mother syrup)
11	ASP	1	300	2		
12	WAIT	5				
13	HEIGHT	0	2			Aspirates air
14	ASP	1	5	2		
15	TUBE	0	0			Washes outer needle wall
16	TUBE	6	I1			Dispenses sample + diluent
17	DISP	1	3010	2		
18	WAIT	5				Switches INJ. valve
19	HEIGHT	0	2			Aspirates air
20	ASP	1	50	2		
21	TUBE	6	I1			Mixes and stirs (10 times)
22	DO	10	10	1	1	
23	ASP	1	2400	2		
24	DISP	1	2400	2		
25	LOOP					
26	WAIT	30				
27	TUBE	0	0			Washes inner and outer needle walls
28	DISP	0	0			
29	SVALVE	1	0			Aspirates washing liquid from washing liquid bottle (dead volume)
30	SYRINGE	1	55.0			
31	HEIGHT	0	2			Aspirates air
32	ASP	1	5	3		
33	TUBE	6	I1			Aspirates sample 30 µl(Vl) + 50 µl(INJ) + 30 µl(Vr)
34	ASP	1	110	3		
35	WAIT	1				
36	HEIGHT	0	2			Aspirates air
37	ASP	1	5	3		
38	TUBE	0	0			Washes outer needle wall

(cont'd)

Line No.	Command	Parameter			Description
39	TUBE	0	1		VI dispensing 30 µl(VI) + 5 µl(AIR) + 45.0 µl(Vd)
40	DISP	1	80	3	
41	WIAT	1			
42	VALVE	1			Switches injection valve
43	WAIT	1			
44	DISP	1	50	3	Dispenses INJ. VOL
45	WAIT	1			
46	VALVE	0			Switches injection valve
47	OUT	1	1		EXT. START signal ON (1 second). Sets a stop time of 60 seconds
48	TIMER	60			
49	WAIT	1			
50	OUT	1	0		
51	DISP	1	2500	3	Washes injection port
52	TUBE	0	0		Washes needle
53	DISP	1	2500	3	
54	HOME				Returns to the home position
55	WAIT TIMER				Waits for stop time.
56	LOOP				Returns to DO in line No. 1.

Note: Line No. 11 and 17 determine the dilution factor. Line No. 11 designates the aspiration volume. Line No. 17 designates the diluent and air volumes.

2. When the Washing Liquid and the Diluent Are Different

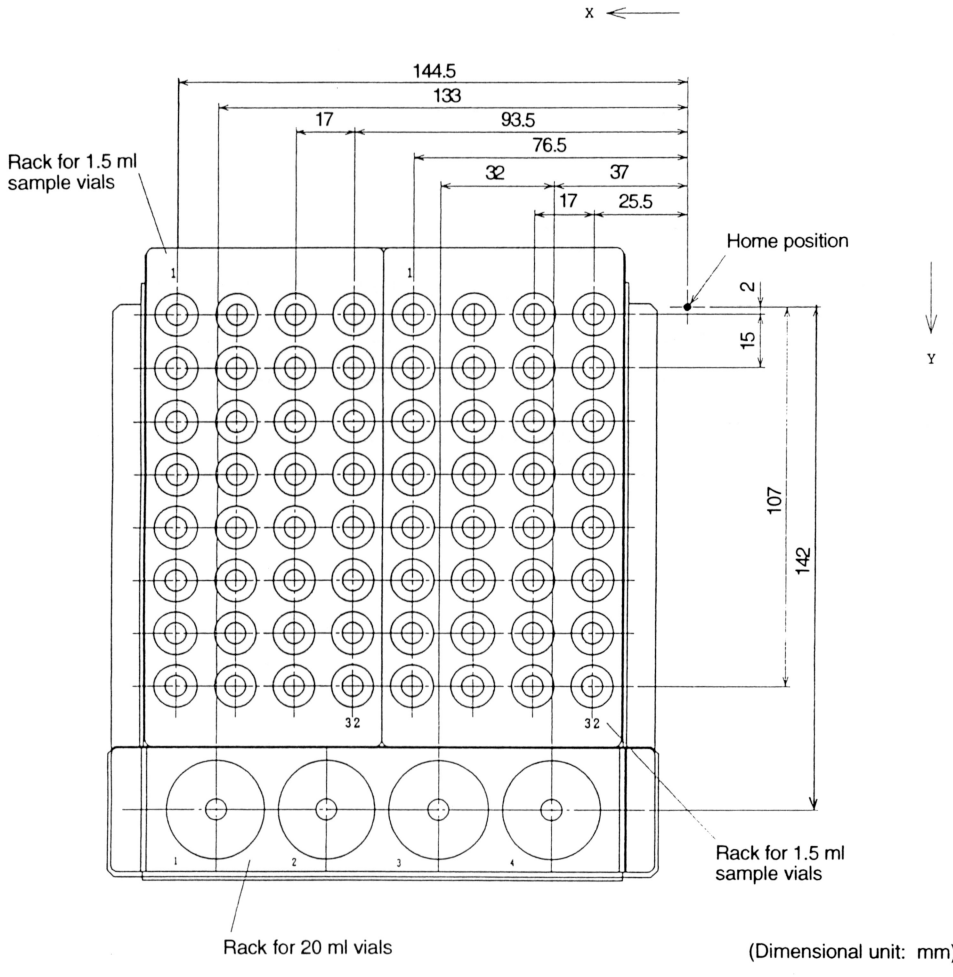
In this example, the diluent is in a vial in the rack. Aspirate the diluent with the needle and dilute the sample.

2a. Conditions

Sample: 20 µl, Diluent: 780 µl, Mixing: 5 times

Sample injection volume: 1 0 µl

2b. Rack Installation and Parameter Details



(Dimensional unit: mm)

CODE	X_1	X_2	Y_1	Y_2	N_x	N_y	Z	P
11	37.0	142.0	133.0	142.0	4	1	57	1
12	25.5	2.0	76.5	107.0	4	8	36	1
13	93.5	2.0	144.5	107.0	4	8	36	1

2c. Program

Line No.	Command	Parameter				Description
1	WAIT SIGNAL	3	1			
2	HOME					
3	DO	32	10	1.0	1.0	
4	HEIGHT	0.0	2			Air (5 µl)
5	ASP	1	5.0	5		Air (5 µl)
6	WAIT	1.0				Air (5 µl)
7	TUBE	11	1			Aspirates diluent (I2 µl)
8	ASP	1	I2	5		Aspirates diluent (I2 µl)
9	WAIT	1.0				Aspirates diluent (I2 µl)
10	HEIGHT	0.0	2			Air (5 µl)
11	ASP	1	5.0	5		Air (5 µl)
12	WAIT	1.0				Air (5 µl)
13	TUBE	0	0			Aspirates diluent (I1 µl)
14	TUBE	12	I10			Aspirates diluent (I1 µl)
15	ASP	1	I1	5		Aspirates diluent (I1 µl)
16	WAIT	3.0				Aspirates diluent (I1 µl)
17	HEIGHT	0.0	2			Air (5 µl)
18	ASP	1	5.0	5		Air (5 µl)
19	WAIT	1.0				Air (5 µl)
20	TUBE	13	I10	2		Dispenses sample and diluent
21	DISP	1	I3	5		Dispenses sample and diluent
22	WAIT	3.0				Dispenses sample and diluent
23	TUBE	0	0			Washes needle (outside)
24	DISP	1	500.0	5		Washes needle (outside)
25	HEIGHT	0.0	2			Aspirates added diluent (I11 µl)
26	ASP	1	5.0	5		Aspirates added diluent (I11 µl)
27	WAIT	1.0				Aspirates added diluent (I11 µl)
28	TUBE	11	1			Aspirates added diluent (I11 µl)
29	ASP	1	I11	5		Aspirates added diluent (I11 µl)
30	WAIT	1.0				Aspirates added diluent (I11 µl)
31	HEIGHT	0	2			Dispenses added diluent
32	ASP	1	5.0	5		Dispenses added diluent
33	WAIT	1.0				Dispenses added diluent
34	TUBE	13	I10			Dispenses added diluent
35	DISP	1	I12	5		Dispenses added diluent
36	WAIT	3.0				Dispenses added diluent
37	TUBE	0	0			Washes needle (outside)
38	HOME					

(cont'd)

Line No.	Command	Parameter				Description
39	ASP	1	30.0	5		Mixes and stirs (5 syringe strokes)
40	WAIT	1.0				
41	TUBE	13	I10			
42	DO	5	I5	1.0	1.0	
43	ASP	1	I4	4		
44	WAIT	1.0				
45	DISP	1	I4	5		
46	WAIT	1.0				
47	LOOP	1.0				
48	WASH					
49	SVALVE	1	0			Vd aspiration
50	SYRINGE	1	45.0	5		
51	HEIGHT	0	2			Air (5 µl)
52	ASP	1	5.0	5		
53	TUBE	13	I10			Aspirates mixture
54	ASP	1	I6	5		
55	ASP	1	I7	5		
56	ASP	1	I8	5		
57	WAIT	1.0				
58	HEIGHT	0.0	2			Air (5 µl)
59	ASP	1	5.0	5		Washes needle (outside)
60	TUBE	0	0			
61	TUBE	0	1			Loads sample
62	DISP	1	I7	5		
63	DISP	1.0	50.0	5		
64	WAIT	1.0	50.0			
65	VALVE	1				Sample injection
66	WAIT	1				
67	DISP	1	I6	5		
68	WAIT	1.0				
69	VALVE	0				
70	OUT	1	1			Sets stop time
71	TIMER	I9				
72	WAIT	1.0				
73	OUT	1	0			
74	DISP	1	1000.0	5		Washes valve
75	TUBE	0.0				Washes needle
76	DISP	1	1000.0	5		
77	WAIT	1.0				Waits for stop time
78	WAIT TIMER					
79	LOOP					

2d. Variable Parameters

Variable	Input Value	Description
I1	20	Sample volume (μl)
I2	450	Aspiration volume of diluent (μl)
I3	410	Sample volume + diluent + air dispensing volume (μl) = 20 + 380 + 10
I4	450	Aspiration, dispensing volume when stirring (μl)
I5	1	Stirring number
I6	10	Mixture injection volume (μl)
I7	30	Lead volume (μl)
I8	30	Rear volume (μl)
I9	600	Stop time (600s)
I10	1	Sample No.
I11	450	Aspiration volume of the added diluent (μl)
I12	405	Added diluent + air volume (μl) 400 + 5

APPENDIX 1 ERROR MESSAGE LIST

No.	Error Message	Description
1	ERROR-X!	Arm X (transversely) movement error
2	ERROR-Y!	Arm Y (longitudinally) movement error
3	ERROR-Z!	Needle Z (vertically) movement error
4	NO TUBE!	Test tube (vial) detect error
5	ERROR-SYRINGE(1)!	Syringe's movement error
6	ERROR-SVALVE(1)!	Syringe valve's movement error
7	ERROR-IVALVE!	Injection valve's movement error
8	ERROR-ACC!	Accessory movement error
9	ERROR-PARAMETER!	Parameter is out of range
10	ERROR-D-LINE COMMUNICATION! D-Line SYSTEM IS NOT READY	Unsuccessful D-line communication with the master station. (Cause: Power switch of master station (data processor) has been turned off or the D-line cable is not connected.) (Remedy: Turn on the master station and/or connect the cable.)
11	ERROR-NO PROGRAM!	No program is present in the editor buffer
12	ERROR-NO FILE	The specified program number file cannot be found in the RAM disk when you process the **FILE** functions of LOAD, DELETE and DIRECTORY.
13	ERROR-SYNTAX!	1) The DO and LOOP numbers do not matched. 2) DO and LOOP sequence is reversed.
14	ERROR-OUT OF MEMORY(1)	No area is available to add a command during the TEACH or the EDIT processing.
15	ERROR-OUT OF MEMORY(2)	During the SAVE operation, the program in the editor buffer can not find a continuous area in the RAM DISK. (Countermeasure: Delete unnecessary files. Condense to form one integrated area of all the separated free areas.)
16	ERROR-COMMAND!	An illegal command was found in the program. (Countermeasure: Press the **TEACH** key, select 1) YES to delete the program in the buffer area. If the program was saved in the RAM DISK, delete it with the DELETE function.)
17	ERROR-RS-232C	Data or and @ mark from an external computer could not be transferred to the autosampler within the 60 second time limit. (RS-232C mode)

(cont'd)

No.	Error Message	Description
18	CHECK VIAL NO.	1) The vial No. exceeds Nx·Ny (total number of vials) of the RACK parameter was set when the analysis started (when the START was pressed). 2) The starting vial No. is greater than the last vial No.
19	CHECK TOTAL VOL.	1) The CUT VOL. or INJ VOL. is greater than the sum of the CUT VOL. + INJ VOL. + 55 µl for the current syringe capacity. 2) The 'FEED VOL' or 'INJ VOL' parameter value is larger than the actual capacity of the current syringe (feed volume + injection volume + 55 µl). 3) The 'WASTE VOL' or 'INJ VOL' parameter value is larger than the actual capacity of the current syringe (waste volume + injection volume + 55 µl).
20	CHECK SYRINGE SPEED!	The syringe speed set with the UTILITY function (SYRINGE SPEED, WASH SPEED) exceeds the upper limit values given in Table 2-4 (when a 2.5 ml or a 5 ml syringe is used).
21	CHECK START STEP NO!	1) When starting an analysis (START key pressed), the START STEP NO. not present in the program. 2) When setting the START STEP NO. with the UTILITY function, the system is trying to access a step that is not present in the program.
22	CHECK D-LINE MODE!	The D-line communication mode is not set up or the PRINT function (UTILITY menu) is trying to print but the printer is not active.
23	SYSTEM BUSY: CHECK OTHER MODULE STATUS!	Analysis cannot start because the other module connected is busy.
24	ERROR-COOL UNIT1	Error of the thermoelectronic rack (No. 1)
25	ERROR-COOL UNIT2	Error of the thermoelectronic rack (No. 2)
26	ERROR OPVAVLE	Error in the option valve